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I Rode the Mustang and Didn't Get Thrown

by Harlan Gray Sparrow III

It all started several months ago when I asked if I could participate on a Flight Standardization Board (FSB). For those who don't know, an FSB is a designated group of operations inspectors who determine type rating, certification, and training requirements for new or modified aircraft. I knew that there would be several opportunities to be part of an FSB because of the new light jets being built. I was pleasantly surprised when I was assigned to the Cessna *Citation Mustang* CE510 Board.

Now the work begins. Having already read what our inspectors handbook, FAA Order 8700.1, stated, I felt like I had a good start on what part I would play on the Board. Like many things we experience in life, it is never as simple as it looks.

My first day on the job was in a classroom in Wichita, Kansas, being briefed by our Board Chairman, who is from the FAA's Aircraft Evaluation Group (AEG), as to what was expected of each of us during this board. We had quite an interesting mix of inspectors. There were two inspectors from Washington Headquarters, myself from Commuter On Demand and Training Center Branch (AFS-250) and another inspector acting as an official observer from Certification and General Aviation Operations Branch (AFS-810); two inspectors from the AEG office; one inspector from Simulator Certification Branch (AFS-205); and one inspector from the Wichita Flight Standards District Office (FSDO). We also had a very nice gentleman, who had retired from the United Kingdom's Civil Aviation Authority and was now with the European Aviation Safety Agency. He was representing the Joint Operational Evaluation Board (JOEB) as its Chairman. When the briefing from our Board Chairman was completed, our ground school started.

Cessna has chosen Flight Safety International (FSI) to provide the ground school training. As soon as the aircraft flight simulator is certified, which should occur in early 2007, the simulator training should follow soon after.

Our ground school started, as most do, with a basic introduction to the aircraft. Next subject was the electrical system which is all direct current (DC). This offers several advantages, such as simplicity, over other aircraft which normally have DC and alternating current (AC) electrical systems. By designing the electrical system for DC, Cessna eliminated some of the challenges that go with using both AC and DC. The electrical system was followed by the aircraft lighting system. After that, our first day was complete.

Our ground school training was quite unique because the curriculum was still as one inspector put it, "a work in progress." Part of our job was to evaluate the ground school program and make recommendations as to the content and the areas that should be changed, strengthened, or eliminated. As you can imagine with a

Cessna photo

classroom of FAA inspectors there was no lack of input. The Flight Safety instructors were true veterans and worked hard to polish their product.

Day two of ground school started out with the aircraft fuel system, which turned out to be elementary. The Flight Safety instructor used the "KIS" principle, "Keep It Simple." Each wing has a tank feeding into the engine with a simple cross feed system in case you need to supply fuel to both engines from one tank or balance the fuel load in the case of single engine operations. The next session involved power plants. The Pratt and Whitney PW615F-A turbofan engines each produce 1,460 lbs. of thrust. Several hours were devoted to explaining and demonstrating the various parts of the engine. After engines came engine fire protection. This system has a single fire extinguishing bottle which can be directed to either engine by the pilot. The aircraft flight controls are the standard cable configuration, which are very smooth, requiring little effort to manipulate. The hydraulic system was next. Some aircraft have a very elaborate hydraulic system. However, the *Mustang* is not one of them. The landing gear is raised and lowered by a single hydraulic pump, located in the nose compartment. If that pump should malfunction, there is a manual backup system which has a nitrogen bottle to provide pressure. Finally we get to the brake system. The brakes are pretty standard with antiskid for those with heavy feet.

Day three was good old performance and flight planning. It included everything there is to know about how to get the most out of the *Mustang*, when you take it into the friendly skies. Because there is a proper method to load the airplane, we rolled right into aircraft weight and balance class. In an effort to cool us off after several hours of numbers crunching, we discussed air conditioning, which is a simple vapor cycle cooling system.

The afternoon was filled with discussions on aircraft pressurization and how to properly manage the system. If you follow the checklist during the initial startup, it is almost "pilot proof" (definition: hard to mess up). The onboard oxygen system, which is for emergency use, is a simple drop down system like the airlines use. Winding up the day was a lecture about ice and rain protection. The pilot windshields, or wind screens, are electrically heated. The really important surfaces, such as the wing leading edges and tail section, have inflatable deicing boots, which is a simple, yet effective, deicing system.

Day four was devoted to avionics. The Garmin® G1000™ system will require some new skills. I had done some reading about the Garmin system and was fortunate enough to get some instruction from Susan Parson, special assistant in Flight Standards' General Aviation and Commercial Division, before I came to Wichita. The Garmin system is much more than an avionics system. Not only does the system handle all of the traditional instrument and avionics functions, it interacts with all of the aircraft systems. At first it seemed overwhelming, but I soon learned there was a plan to teach us what we needed to know in order to become proficient with this new marvel of avionics. All morning was spent on breaking down the package into manageable pieces. There was a very logical process to learning the system, but patience was needed on our part. After lunch we relocated to the Engineering Test Facility where the "Iron Bird" resided. Cessna had built a basic cockpit in order to test the functions of the G1000. Located on a table about three feet high were two pilot seats and a panel resembling the work place where we pilots are most comfortable. They had even built a simple visual system that was actually quite good. Some would call this an FTD (flight training device). However, it wasn't built for that purpose. Pilots going through training won't see this device. They will use an actual FTD and, when that training is completed, the simulator. The only reason we were allowed to use this device is because the simulator wasn't built yet. This device was a terrific help in allowing us to see what happens when we manipulate the system buttons.

Monday was our first day to fly the new light jet. Preflight was pretty straight forward. As is usual, you need someone to show you where everything is located so you can check it. Cockpit prep was a new learning experience. For those who are used to round gauges you will be disappointed to learn that most of them are gone. The world has gone digital! They did take pity on us old guys and left three nice round gauges, although they are for emergency use only. It was nice to have a couple of familiar instruments/faces. There I sat with three huge screens in place of the good old instrument panel. This was to become my new friend. Learn it or perish. Fortunately we had an instructor that was an Ace with the Garmin® G1000™ . Later on, he did admit that he didn't know everything about it. I'm not sure the engineers do either. Nevertheless, our expert was the "resident genius," and I for

one was thankful for his expertise.

Cranking the engines was as simple as starting a car. You push the start button, move the throttle from cutoff to idle and wait. The FADEC (Full Authority Digital Engine Control) takes over after starter release. Did I tell you the FADEC, which automatically controls the engine power settings by adjusting fuel flow, is now my new best friend? Talk about simple. Takeoff requires you to push the throttles forward into the Takeoff detent and the FADEC does all the rest. After takeoff you pull the throttles back to the next lower Climb detent and you have climb power. When you reach your cruise altitude you pull the throttles back to the cruise detent. Life just became much simpler.

The *Mustang* handles like a Cessna 182 that has grown some additional horse power, not to mention another engine. The controls are responsive with no surprises. We went straight to 10,500 feet to do some stalls and steep turns. The stalls were docile and the airplane recovered without any secondary stalls. I flew it until we got a buffet, just to see what it felt like. No big deal. The steep turns were uneventful as long as I remembered to trim the elevator. Otherwise I had to pull quite a bit, just like many other airplanes I have flown.

Now the easy part was over and I had to get back to work. They actually expect you to use all of the systems embedded within the Garmin® G1000™. You guessed it; approaches were next. We started out with a GPS approach into Hutchinson (KHUT), Kansas. It seems this airport, which is not far from Wichita (KICT), is a popular place to go because it has lots of approaches to offer. I was to find out in the next couple of days the intimate parts of each approach. Our instructor was determined for us to be as proficient as possible for our check ride. While I do agree with our instructor, it did seem like we were trying to learn it all the first day. I was slaving away on one of the approaches when I was cleared to land, but with a caution. It seems that there were several flocks—gaggles, herds, or whatever you call them—of turkeys on the airport and the tower warned us of them. As if I didn't have enough to do, now I was on turkey watch as well. Upon reaching the DA (decision altitude) I looked up and found the runway right where it was supposed to be. I also found the turkeys as well, gathered around the approach lights. The rest of the approaches were less eventful. I was happy to trade seats with my flying partner. Turkeys and approaches were a full day for me—but hmm, Thanksgiving is coming. The rest of the day was spent in the classroom finishing our ground school.

Tuesday we were scheduled to fly the morning and afternoon periods. It seems that we were in store for more of the same in the way of maneuvers and, of course, endless approaches. I love flying; however I was one tired aviator after the day was done.

Wednesday morning we spent at the "Hot Bench." This is another engineering tool that we were fortunate to have for our use. Cessna had set up the Garmin® G1000™ panel so that they could do tests on it. We were allowed to use it for practice. I was lucky to have my flying partner for a mentor. She had attended the TAA (Technically Advanced Aircraft) training at Embry Riddle University (this writer's alma mater) located in Daytona Beach, Florida. This previous training was a big help for both of us. Since she had already been introduced to the Garmin® G1000™ in a single engine airplane, we discovered there were a lot of similarities with the *Mustang's* G1000 system. The afternoon was spent flying many, many approaches into Hutchinson. We were scheduled to take our final evaluation on Thursday. However, our Board Chairman decided to give us another day of practice. Though we felt ready to take our checks as originally scheduled, none of us turned down the opportunity to fly the airplane some more. Okay, I admit it. We were having a lot of fun flying this new prototype airplane. Besides, the extra practice was put to good use. It seems our instructor was determined to give us a workout, so we did a practice check ride in preparation for the real one on Friday.

Friday finally arrived and we all took our final single-pilot check ride. The airplane can be flown with one or two pilots. We elected to do the single pilot evaluation since we would be expected to evaluate other pilots for this type of certification. After working so hard in preparation, the final evaluation was rather anticlimactic. It was not boring, we were just well prepared.

Our Board Chairman called a final meeting for our comments and recommendations. Though the process of completing all of the other necessary Board requirements will take several weeks and possibility even a couple of months, this phase was complete.

Reflecting back over the past couple of weeks, I would have to say that serving on this Board was a real eye opener on what it takes to get a new airplane certified.

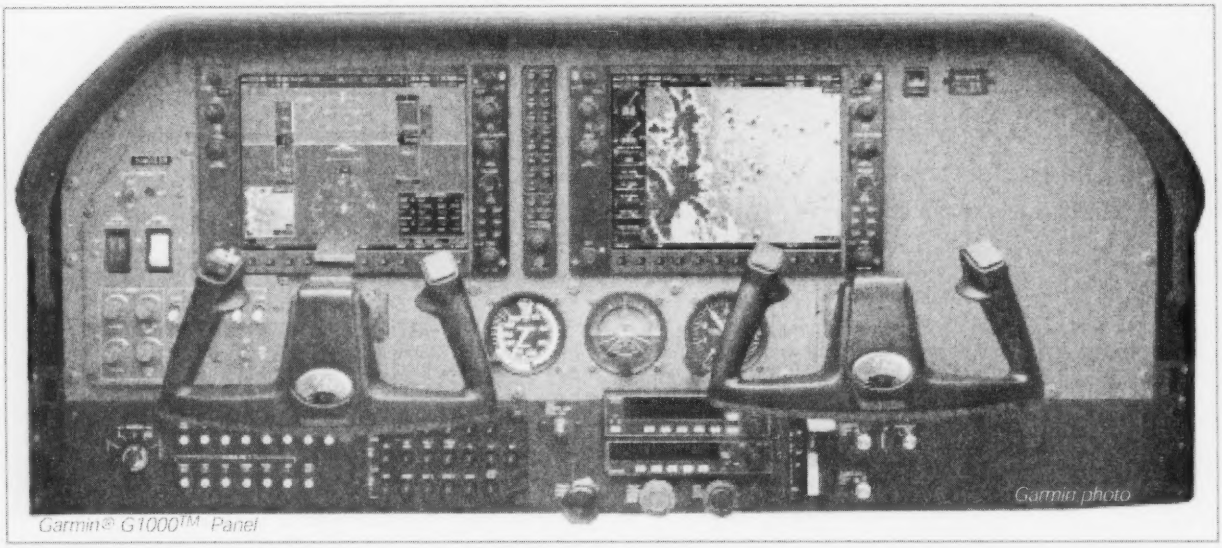
I wonder if they will let me do the FSB on the new Boeing 787. It never hurts to ask!

Harlan Gray Sparrow III is an Aviation Safety Inspector with Flight Standards Service's Air Transportation Division.

Modern Aircraft Electrical Systems

How well do you know your aircraft?

by Michael G. Gaffney, NAFI MCFI



Garmin® G1000™ Panel

I recently realized that I have been flying for over 30 years and I have been an A&P mechanic for 25 of those years. In all the time that I have spent around aircraft and the people who love them, I have rarely found pilots who understood the electrical systems of their aircraft. Why should they, one might reason, since the manufacturers of most light general aviation aircraft did not provide enough accurate information to the pilot to make any difference until an alternator or generator failed. Until recently, a manufacturer was content to provide an ammeter or a voltmeter, but seldom both. For a while, Cessna provided us with an over-voltage light, which, while coupled with the ammeter, would supposedly tell us about certain electrical malfunctions. In general, it wasn't until we got into more complex aircraft or twins would we be provided with enough accurate information about our electrical systems operation and health to make intelligent operational decisions.

With the introduction of Technically Advanced Aircraft (TAA) outfitted with sleek Garmin® G1000™, Avidyne®, and other assorted glass cockpit panels and FAA/Industry Training Standards (FITS) scenario-based training techniques to help pilots fly more safely, the training industry has finally recognized that pilots must be trained to a higher level of understanding of the electrical systems that supports all that equipment. This article will help pilots better understand how to evaluate these threatening situations, if and when an electrical failure forces them to make load shedding decisions to complete the flight safely.

When I teach these FITS/TAA ground school pilot programs, I start with a definition of the ultimate worse case scenario: Apollo 13 and its dramatic return to earth after suffering catastrophic damage resulting in crippling power failure. Most pilots nod their heads as they remember Tom Hanks playing the role of Jim Lovell in the blockbuster movie which memorialized that day when Americans, and in fact people from around the world, were glued to their TVs and radios watching and listening to the mission control experts trying to figure out how to get power out of the remaining charge left in the ship's batteries. In the same way, we as pilots may one day be called to make similar decisions (without the world watching) in order to get our aircraft and our passengers to safety after suffering a simple alternator belt failure. As with Apollo 13, our aircraft battery has a finite capacity of power and it becomes our job to make decisions on the restriction or limitation of the aircraft's power consumption that allows us to make it to safety.

Now many pilots think this will never happen to them. Ask any group of pilots for a show of hands who in their aviation career have suffered an electrical failure and you will almost always get one half of the group to acknowledge and are quick to offer up some hair-razing story about their ad-

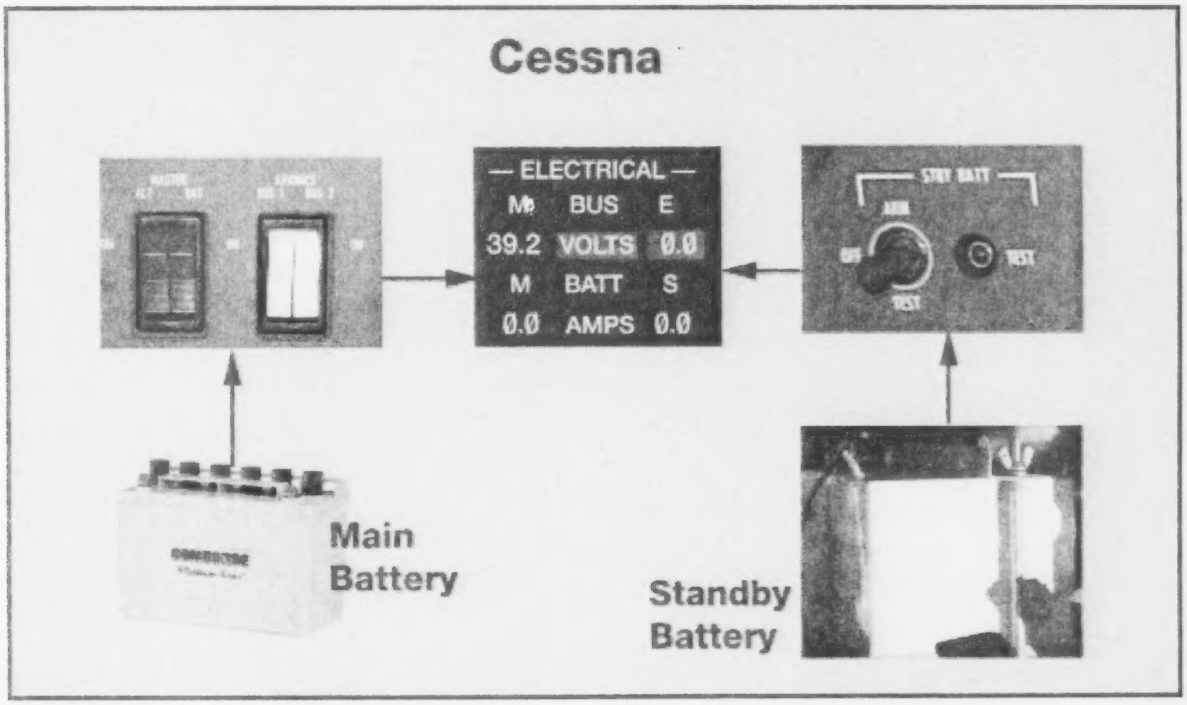
venture. Further ask them to describe the specific defects they suffered and you would expect to get a list of answers ranging from dead batteries and broken alternator belts to broken wiring terminals and popped circuit breakers to dead short-circuits to problems with regulation and power control devices. Surprisingly, many of them cannot even tell you what happened because "it just went dead" and the mechanic never told them what they found. It is amazing, in an industry that depends upon electrical power to keep life simple in the cockpit, that pilots and the flight instruction community are so nonchalant about understanding the central nervous system of the machines we fly.

Electrical System Basics for Pilots

Let us start with a few basics and then we can see what a pilot needs to know to be ready for the day when the screens start to go dim. The electrical system of every modern vehicle has a number of key components: A battery for storing power, a generator or alternator to produce power after engine start, regulation equipment to control the power output and provide a trickle of that power back to the battery to keep it at peak charge, circuit breakers to protect systems from abnormal power draw arranged into logical system groups called buses, power consuming devices located throughout the aircraft otherwise known as "appliances," and wiring to direct power from the circuit breaker bus to the appliances via the switches and then back to ground completing a circuit. That is essentially the design of everything from motorcycles to spacecraft. The only difference is in the details incorporated by engineers to provide safety and redundancy based upon the vehicles mission needs. An auto or motorcycle can pull over to the side of the road so very little redundancy is built into the system. A spacecraft and an airliner have secondary and tertiary systems built into the system because failure tolerance must be minimized.

A general aviation aircraft, depending upon the intention of that aircraft to accept adverse conditions as part of its mission profile may have secondary portions of its systems to provide redundancy. The more sophisticated (expensive) the aircraft, the higher the chances that it will be flown in "hard" IFR, mountainous terrain, night-time, or over-water conditions, the more likely the electrical system will have backup components to protect the pilot. As general aviation continues its venture into offering glass cockpit panels and TKS anti-ice systems, you start seeing corresponding increases in electrical component redundancy. Mooney, Columbia, Cirrus, and Beechcraft all are outfitted with dual alternators and dual batteries. Symphony, Diamond, and Cessna are outfitting their G1000 and Avidyne equipped aircraft with standby batteries providing varying amounts of protection to the pilot in case of electrical problems.

So if the systems are designed by engineers to be safe and redundant, then what goes wrong? We can break failure modes into a number of categories. This in turn can help pilots develop a strategy for combating the failures. The main failure modes are: battery decay and failure, alternator or



generator internal or drive failure, regulation and control failures, popped circuit breakers caused by system overloads, wiring issues caused by wear and tear or insulation breaches, switch failures, or appliance internal failures themselves.

Make it Simple

So what exactly does a pilot need to know, one might logically ask themselves? Pilots are not mechanics and the last thing they need to know to fly is a lesson in Ohm's law. I hear it all the time. Pilots want to simplify their lives, not make it filled with technical detail. OK, let's make your life simple. There are two things that a pilot needs to know about electrical systems during normal operations: system voltage and alternator output (amps). You keep these items in your scan flow and ensure that voltage and current are in proper parameters and you can focus on the rest of the mission profile —getting safely to your destination. Short of a G1000 or Avidyne® Entegra panel flashing warnings at the pilot letting them know that something is awry, what parameters of performance are we looking for? Basically, the pilot has control over key aspects of system performance prior to receiving a cautionary alert from the system. Let's look at the key areas the pilot can incorporate into their Aeronautical Decision Making (ADM) knowledge base.

The Battery

Almost all IFR certified aircraft manufactured since 1990 are 28 volt systems. That means the battery has an internal voltage of 24 volts. Then why is the system 28 volts and why does this matter? The first 24 volts provides the voltage required to run all the aircraft appliances and the last four volts provides the push necessary to trickle charge the battery keeping it at a peak charge ready for the next aircraft start (or restart) or to stand ready as the reserve for running the systems should the alternator or its support systems fail. How long will a battery stay at 24 volts should the alternator fail? Batteries are rated in terms of amp/hours—in other words how many amps will the battery supply for one hour in order to supply a rated amount of voltage. The average 24 volt GA battery installed in a production four-place IFR capable aircraft provides about 15 amp hours of power at a full charge (usually until a preset voltage limit such as 20 volts for a 24 volt battery). That begins to diminish as soon as the battery is placed into service. That also diminishes rapidly in cold temperatures. The state of charge of the battery at the time of the alternator failure will determine the number of minutes the battery can keep the systems going before screens go dim. The pilot should be wary as the amp hour rating (even at a full charge) is not necessarily linear. As the battery starts to work to power everything in the aircraft, such as might occur with a failed alternator, the voltage also starts to drop and many radios and other appliances drop off line at particular voltages, but long before the battery is actually dead. The G1000 has built in load shedding capabilities. At reduced voltages, say below 22 volts, the transmitter outputs are reduced automatically from 16 watts to 10 watts and the screen brightness is drastically reduced. Below 20 volts, many appliances simply cease to function.

If the pilot attempted to takeoff with a discharged battery, such as might occur after a prolonged departure delay with all lights aglow with the engine at idle, the battery may only keep the systems going for a few minutes and that would just get worse in cold temperatures. Not a place that a prudent pilot wants to be, is it? Another avoidable situation is when pilots attempt a takeoff immediately after getting a jumpstart. That battery has not had a chance to fully be restored to a reasonable charge level. A prudent pilot would request a proper charge (in accordance with the battery manufacturer's recommendations) prior to attempting a departure. To not do so is asking for trouble. The rule of thumb is that if the battery is not strong enough to start the engine, then it is definitely not ready to support the needs of the flight should the alternator fail. In fact, many FAA inspectors would argue that the aircraft is not airworthy without a properly charged battery prior to flight.

This leads us to the concept of "critical idle speed." Critical Idle Speed (CIS) is defined as the minimum speed at which the aircraft engine can be idled so that the alternator will provide the power to completely power the systems and still replenish the battery back to full charge. This speed is definitely not the minimum idle speed of the engine. Take for instance a Cessna C172SP. The G1000 panel does a great job of letting us know both the system voltage and the current (amp) draw at all times. If the pilot is waiting for takeoff clearance and sits with the throttle pulled all the way to the stop with just the beacon light on, the RPM would be about 675 RPM. Look at the ammeter and you would see that you are drawing a negative current of about -9.0 amps. Push the throttle forward slightly to about 900 RPM and the pilot would see the amp draw advances to +1 amps. The point where the amp draw switches from negative to positive is defined as the "critical idle speed." If pilot should allow the battery to be drawn down by a negative charge situation prior to takeoff, the battery is in a disadvantaged con-

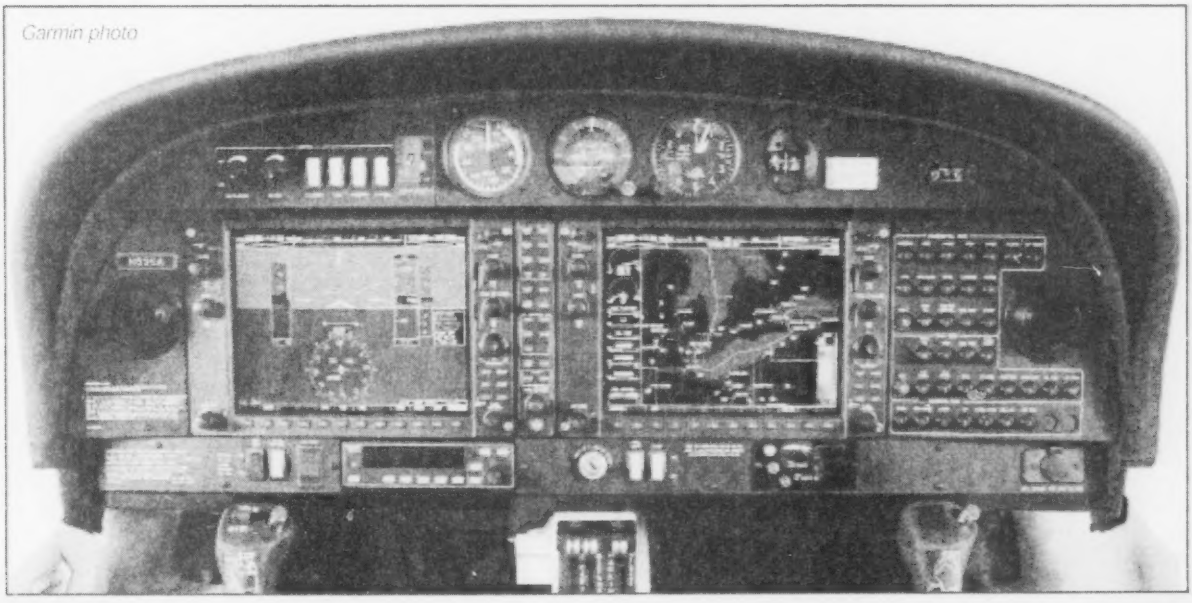
dition. Other than taxiing, the pilot should use this or even higher RPM speed, as the minimum idle setting awaiting takeoff release. On a Diamond aircraft or on Pipers where the ammeter starts at 0 and only shows positive, the critical idle speed is the speed at which the voltage reaches 28 volts, if a voltmeter is installed. On these systems, when the speed is idled too low, the voltage falls from 28 volts and the ammeter only reflects system consumption. Our G1000 equipped Diamond DA40 requires an idle speed of over 1,000 RPM in order to ensure a fully charged battery condition. These idle speeds will vary with equipment turned on and the temperature outside. The worse case scenario will be a cold night flight. This would require the highest idle speed to keep the battery at peak charge prior to brake release.

Load Shedding

Any failure in the charging system would result in a fallback to the raw battery voltage of 24 volts (on a good day) and would require the pilot to start the process of "load shedding" to effectively conserve power until a safe landing can be made. Load shedding is defined as deciding what systems to shut down and in what order to reduce the power consumption of the finite power remaining in a battery. Some systems can be shut down using the appliance switch, such as pressing the power button off on the autopilot, and some may require a toggling of another system control switch such as the avionics master switch (or 1/2 of it) or the alternator side of the master switch. A pilot must avoid the use of pulling a circuit breaker for the purposes of removing power.

How does the pilot know what to turn off and in what order? This is a great question and the answer leads to the reason why this training is so fundamental to safely flying TAA aircraft. The answer to this question comes directly from my friend and colleague Gregg Maryniak, Executive Director of the XPRIZE Foundation and Executive Director of the St. Louis Science Center McDonnell Planetarium. "If it spins, heats, or lights – turn it off," says Gregg, an electrical engineer and space scientist. The simple truth is that nonessential (at that moment) electric appliances such as lights, gyros, flap and gear motors, autopilot servos, and fuel and gear pumps are the heaviest consumers on the vehicle and must be the first to be eliminated to buy time and reserve power needed later in the flight. Because of the design of these systems, simply turning off the power switch may not be enough. A great example is the autopilot. When the average autopilot is turned off at the panel on/off switch, there may typically still be power flowing to remote sensors, trim servos, and feed circuits. In order to stop all this power flow, it may be necessary to pull the circuit breaker. Another example is the alternator side of the master switch. In a condition where the alternator were to fail or the drive belt were to break, leaving the ALT switch on may result in a consumption of almost 1.5 amps of power flowing to fill the coil windings of the device and the regulators and other control boxes of the system. Considering that the average aircraft battery only has 15 amp/hours available on a new battery with a full charge, that 1.5 amps could be used elsewhere such as one last radio transmission or having enough power to extend the flaps right before landing.

One of the things that we have learned with the introduction of the G1000 and Avidyne® Entegra panels and the digital electrical system displays that support them is exactly what power consumption each appliance uses. We used to hear instruc-



Garmin photo

tors teach pilots to turn off the transponder first after an alternator failure—it is the highest power consuming appliance because it both receives and transmits. That may have been true in the days of the older analog style transponders, but it is not true anymore. What we now see by switching on and off these solid state components is that the transponder and each of the other radios of the system only consume about .5 to .75 amps of nominal power where a landing light and a taxi light each take almost seven amps. That means that after a failure of an alternator, a pilot's judicious load shedding of external lights could almost triple the amount of time the battery could support the radios. Now we are getting at some useful information that a pilot can use.

Power Buses

Traditionally, general aviation aircraft had two banks of circuit breakers: the main bus powering everything electrical on the aircraft, and the avionics bus powering the radios. These systems provided a simple separation of the two groups of systems by an avionics master switch. As aircraft avionics grew more complex, we saw a trend where the avionics panel was split into multiple groups and were powered by multiple avionics master switches. This provided a very quick way to isolate or load shed a group of essential avionics from a group of nonessential ones. As the electrical needs of these modern aircraft have evolved, the manufacturers have again split circuit breakers in the main group into several groups to give the pilot ever more control over the electrical systems that power their aircraft's systems. The most common approach is to split the main bus into a main bus and a secondary bus or to split it into an essential bus and a main bus to make it easier for pilots to accomplish load shedding during an emergency. What is happening is that the power is being split so that under normal conditions, all appliances are available, but under emergency conditions or in situations where the aircraft secondary battery or alternator is being used, the "load-shedded" systems or faulty components can be isolated from essential parts of the system to avoid current draw or secondary failure implications on the remaining system. In many aircraft, these busses are separated by white lines on the circuit breaker panel to help the pilot understand what appliances are on which bus. This also helps the pilot develop a load shedding strategy in the event of an electrical emergency. The pilot of these aircraft must take the time to study these bus arrangements so that when the time comes, they have a defensive plan to get home safely.

Standby Battery Arrangements

We mentioned before that many manufacturers of Technically Advanced Aircraft are outfitting their aircraft with standby batteries. How do these work and how much time does this provide us should an alternator and primary battery fail? In some cases, the second battery is not a full size battery, but in fact may be only a fraction of the capacity of the original with an intent to provide just enough time for the pilot to fly for an extra 20-30 minutes under a severely diminished system availability. A great example of this is the Cessna standby battery installed on the C172, C182, and C206 G1000 equipped aircraft. The second battery provides enough power to run the essential bus for up to 30 minutes. What many pilots who are being introduced to these aircraft may not know is that there is no way for this battery to power any external lights, flaps, pumps, or other systems deemed non-essential. These non-essential systems are simply not connected to the backup battery. The only way to know this is to read the manual or to actually study the layout of the essential and the main bus lines on the instrument panel. What does this mean to the pilot? It means that in an actual electrical emergency, such as an alternator failure, the pilot may need to make a decision to isolate the main battery and exhaust the standby battery FIRST and then turn the main battery back on at the last minute in order to extend flaps or illuminate any external lights for landing. This would be helpful information for the pilot to know prior to having a failure. It would not be a good time for that pilot to be reading the pilot operating handbook with a flashlight gripped in their teeth.

Diamond Aircraft uses a different standby battery arrangement. They use a standby battery similar to an ELT battery to power the standby attitude indicator and LED panel lights. The pilot must activate the emergency battery switch by lifting a switch cover. This battery is not charged by the alternator, but by design provides power for up to 90 minutes. After the main battery is exhausted, the standby battery cannot power any radios or aircraft systems. It simply is there to allow the pilot to use the standby instruments to find a VFR airport and land.

Circuit Breaker, Switch, and Wiring Issues

Less prevalent, but still worth our consideration, are the issues that can occur related to the connective portions of the electrical system between the power buses and the appliances themselves. The circuit breakers are installed in a circuit to prevent current or voltage overloads from traveling to an appliance that is not designed to accept such a load. What would cause a device to suddenly receive a surge from the power bus? Anytime that a device or a wiring fault occurs that allows a direct flow of current from the power bus to ground will cause such an overload. The risk of this to a pilot is twofold. One is that high current causes excessive heat to build up along its path. That heat can cause wires or components within a device to melt or flash-arc to adjacent wires. The second is that the melting of the wire insulation or coating and the other components can cause smoke or even spark a fire in the engine compartment, under the panel, or somewhere in the cabin. Neither of these leaves the pilot any choice but to shut down the electrical systems and start immediately looking for land-

ing options. The circuit breakers of a circuit are designed to interrupt power anytime that rated current is exceeded even for a moment to prevent an overheating of the wires, switches, or the appliance itself. There are two type of circuit breakers currently used in aviation. These are "trip-free resettable" some with plungers and some without. When the pilot can selectively pull a circuit breaker, it creates the illusion that it is a switch. In most cases, this practice is discouraged by FAA Advisory Circular 43.13 because the device could have its internal contacts worn over time so that it no longer could effectively serve its true purpose in the event of excessive current draw.

In TAA glass cockpit training we are faced with a dilemma. We need to teach the pilot to completely understand what the panel looks like when an air data computer or AHRS unit fails so that they respond correctly. Short of dimming screens, there is no other realistic way to selectively fail components during training other than to use the circuit breaker. We urge instructor pilots to use ground training devices and paper tiger trainers rather than to risk the integrity of the circuit breaker panel itself.

The circuit breakers of the power buses are supposed to be labeled with an appliance description and a number representing an overload rating. In most cases the circuit breaker label is self explanatory, such as landing light, taxi light, starter, fuel pump, etc. The problem is where circuit breakers are added by avionics shops over time on older aircraft and the labels are missing or unreadable. It should be the focus of the IA on each annual inspection to make sure that all placards and markings of the aircraft not only be present, but also be legible. Should a pilot fly an aircraft with a circuit breaker that serves an unknown purpose? Title 14 CFR §23.1357 (d) requires that all circuit breakers and other protective devices be clearly identified in order for the aircraft to be airworthy. If the pilot cannot determine what a circuit breaker does, the aircraft should not be flown.

Failure Management

The pilot of a modern aircraft must understand the layout and the operation of their electrical system in order to have peace of mind in the event of an electrical failure. The systems of our currently produced aircraft are so complex that "hop in and learn as we go" training should no longer be practiced by flight instructors and should be prevented by flight training and rental companies. This might have worked for simple training aircraft manufactured in the 70's, but simply is not consistent with prudent risk management strategies today. The flight instructor, armed with the knowledge of FITS training techniques, should use emergency scenarios to train the response of the pilot in training to understand the electrical system down cold. In the modern world of flight training, we call this to practice to the Manage Decide Level of FITS accomplishment. The pilot in training should know the systems just like they do landing procedures or engine out glide to landing procedures.

Conclusion

The principles discussed here are not limited to TAA glass cockpit aircraft but can apply to any aircraft with an electrical system. The pilot must have a working knowledge of the electrical system and its essential, main, and avionic bus layout in order to have the highest chance of combating an electrical system malfunction in other than day VFR conditions. The easiest way to learn the layout is to read the POH and study the white lines or logical divisions of the circuit breaker panels. Keep the circuit breaker panels and the electrical system indicators in your scan flow just like you would the other engine indicators. If the aircraft is outfitted with backup alternators or backup batteries, be aware of the limitations that these may place on your operation of systems and have a good idea of how long you can effectively operate the aircraft in the backup scenario. I can only urge you to really give the aircraft a complete going over on the first flight of the checkout or pilot recurrency check flight. Now, if your next trip turns your aircraft into Apollo 13, you will be ready to return to earth safely and with confidence!

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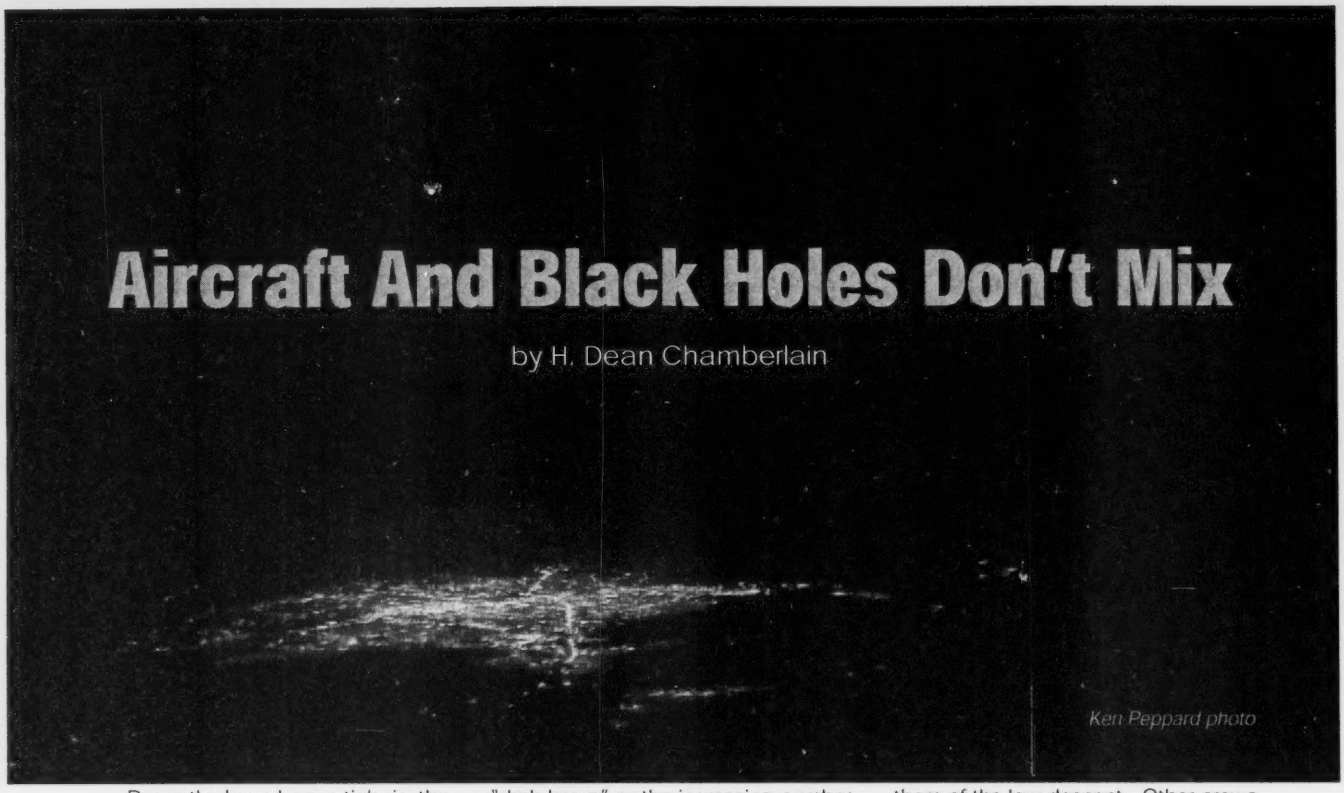
Aircraft And Black Holes Don't Mix

by H. Dean Chamberlain



Ken Peppard photo

Recently, I read an article in the newest publication from the Flight Safety Foundation called *Aviation-Safety World*. The article, titled "Night VMC," written by Dan Gurney, says it is the "First in a series focusing on approach-and-landing incidents that might have resulted in controlled flight into terrain but for the timely warnings by TAWS." The article was about a widebody aircraft's flight crew that misread the published approach procedure while doing a night visual approach. Descending below the published glide path, the aircraft might have been a controlled flight into terrain (CFIT) accident, if the crew had not been alerted by the onboard terrain awareness and warning system (TAWS). The article reminded me that it has been several years since we wrote about this subject from a general aviation perspective. We want to thank *AviationSafety World* for reminding us of the need for such an article.

As we transition from summer flying into fall and winter, one of the important considerations that general aviation pilots have to adjust to is the reduced number of daylight hours. Or to say it a different way, we all have to adjust to the increasing number of "dark hours" or the increasing number of hours of night flying late fall and winter poses.

Although an aircraft doesn't know if it is being operated in daylight or darkness, the impact on a pilot flying at night can be critical (no pun intended). Since this article is only focusing on the risks of night flight, we will leave the risks of preflighting and flying during winter operations to another article that focuses on winter flying and the risks posed by ice and snow.

Although an aircraft may perform better at night due to lower density altitude—for example, than during the midday heat—for the majority of general aviation aircraft, the greatest impact of night flight rests on the pilot flying the aircraft. Simply stated; at night, pilots lose many of the benefits that daylight vision provides. In the case of the widebody aircraft in the article mentioned, it was flying a night visual approach "...to a major airport in a geographically remote area." I think it is safe to say, had the crew been flying the approach during daylight conditions, they would have noticed their descent immediately. However, they had the onboard equipment to remind them of the low descent. Other crews have not been so lucky. There was a Canadian military flight involving a night visual approach accident that was later made into a movie. In the case of the Canadian accident, the "black hole" CFIT accident highlighted a potential problem faced by many pilots. The Canadian flight, if I remember correctly, cancelled its instrument flight plan within range of the airfield and continued its flight visually. The problem was the "black hole" between the flight and the airfield. In the case of the Canadian flight, the black hole was the high ground that the plane hit.

As one of my aero club friends, who was also a flight instructor, once said on a night flight from California back over the mountains and desert towards Arizona, "There is a reason there are no lights out there." He made the statement while we were flying over the mountains east of San Diego en route to Yuma, Arizona. As he pointed out, in many cases, the lack of lights is because people can't build there. This usually means a steep hill, mountain, or water is at the center of the black hole. Of course, depending upon where you are, there just may be a lack of people in the

more remote or open areas of this country, but there is only one way for pilots to be sure. Before flying at night over an area you are not familiar with, do your homework.

All of this presupposes you are mentally and physically able and ready to fly. In a March 2003 FAA report titled "A Human Error Analysis of General Aviation Controlled Flight Into Terrain Accidents Occurring Between 1990 and 1998" (by Scott A. Shappell, Civil Aerospace Medical Institute, FAA, and Douglas A. Wiegmann, University of Illinois at Urbana-Champaign Institute of Aviation), the authors discussed factors relating to CFIT accidents including the pilots' mental and physical conditions. I think, based upon some of the statements made in this report, it is safe to say that, if you have had a long workday, you are stressed out, you are tired, and you plan a long night flight from Point A to Point B, you have a greater risk of having a night CFIT accident. I think this is especially true if you are flying into a strange airport. The report noted the importance of pilots having the required flight skills and being able to make good, sound decisions. I think this can all be summed up by the cliché about good decision making can prevent you from having to use your excellent flight skills to recover from a problem of your own making.

So how do you reduce the risk of a night CFIT accident or incident? If you are an instrument-rated pilot flying on an instrument flight plan, don't cancel your flight plan until you are safely on the ground. Even if you are filing an instrument flight plan, do you carry an FAA sectional chart for the area you will be flying over? The sectional chart shows you terrain flight risks better than an instrument chart. In case you are wondering what I mean, if you are flight planning an instrument route, the instrument charts specify the minimum en route altitudes along your route. However, there may be more than one route to your location. One may be over rough terrain, water, or even mountains that might make an off-airport landing risky. But the alternate route might be over more friendly terrain and might even have an airport or two within easy gliding distance along the route. The route choice is yours whether you are flying on an instrument flight plan or a visual flight plan. If you are flying a high performance multiengine aircraft with a drift down altitude that is higher than the en route terrain, no problem. If you are flying a multiengine airplane with a drift down altitude that is below the rough terrain peaks, or if you are flying a single engine aircraft with a zero drift down altitude, then you might want to consider the more friendly route at night when the risk of an off-airport landing increases. This is just one consideration when flight planning at night.

Another consideration is operations in the terminal area. Since every student pilot has to study many of the visual limitations of the human eye during ground school, we will not republish the *Aeronautical Information Manual* (AIM) and the FAA's *Pilot's Handbook of Aeronautical Knowledge* (FAA-H-8083-25) sections about aeromedical issues involving night vision, spatial disorientation, and illusions that can occur during night flight. However, we do want to highlight a section from the handbook. On page 15-5 in the Pilots Handbook, it states, "Various surface features and atmospheric conditions encountered in landing can create illusions of being on the wrong approach path. Landing errors from these illusions can be prevented by anticipating them during approaches, inspecting unfamiliar airports before landing, using electronic glide slope or VASI systems when available, and maintaining proficiency in landing procedures."

The handbook continues by saying, "A narrower-than-usual runway can create the illusion that the airplane is higher than it actually is, while a wider-than-usual runway can have the opposite effect, causing the pilot to flare too high or overshoot the runway."

"A runway that slopes up, or upsloping terrain, can create the illusion that the airplane is at higher altitude than it actually is and downsloping runways or terrain can create the opposite effect. Rain on the windshield can create the illusion of greater height, and haze can make distances appear greater than they are."

These visual effects are real. So what can anyone do to reduce the risk of a general aviation night CFIT accident or incident? First, if you have access to the Internet, you can search the Internet for additional information. In my search, I found both non-government and government articles and information about night flight. Of particular interest was the amount of FAA material involving helicopter emergency medical services (HEMS) operations. As a January 2006 FAA Safety Alert for Operators (SAFO) stated, "HEMS operate in a demanding environment." The SAFO noted the number of commercial HEMS accidents from January 1998 through December 2004 that involved CFIT, night operations, and inadvertent flight into instrument meteorological conditions (IMC). Of the 21fatal HEMS accidents noted, the SAFO said 21 occurred during night operations.

I am not implying that the average general aviation pilot faces the unique risks the HEMS crews face when landing on a highway somewhere to pick up an accident victim. But the various FAA HEMS reports do point out some ideas that GA pilots can use to reduce their night flight risks.

Some of those ideas include good decision making. The first decision every pilot must make when planning a night flight is, should the flight be made. When applying good risk analysis, the right decision may be to delay the flight until the next day.

Another factor is, how proficient are you flying at night? This involves the perennial question of legal currency versus proficiency. You may be legal, but are you safe. Please note, to ensure night currency involving being pilot in command (PIC) while carrying passengers, your required landings must be to a complete stop in the same aircraft category, class, and type, if a type rating is required. For a complete list of night currency

requirements to be PIC carrying passengers at night, you should review Title 14 Code of Federal Regulations (14 CFR) section 61.57(b). If you are not comfortable flying at night, you should arrange for some night instruction with a qualified and night current flight instructor.

The SAFO also pointed out the need for ground and flight training in aircraft system malfunctions and the importance of good aeronautical decision making including the decision to divert, continue, or terminate the flight.

For those aircraft so equipped, the SAFO pointed out the benefit of using a radar altimeter if available, the use of enhanced vision systems, and the use of a Terrain Awareness Warning System. These are all tools to increase safety which reduces your flight risk. Some of the new GPS-based terrain awareness tools being developed offer a lot of promise.

The SAFO emphasized the benefit of a good weather brief and the possibility of raising your own minimum weather minimums to increase your safety. The need for a complete weather brief and updating that information in flight was also highlighted.

As noted earlier, the need to review significant terrain and obstacles along your route of flight starting from your departure airport to your destination and any required alternate airports cannot be emphasized enough.

One item I don't remember ever seeing before was a recommendation to, "Make pilot compartment, to the extent possible, free of glare and reflections. Ambient light may have been a factor in some of the night accidents." Although the report was referring to helicopter operations, I think this recommendation makes a good point.

Pilots should also reduce personal distractions when taking off and landing. The airline sterile cockpit concept of only operational conversations during takeoff, and below 10,000 feet for some, is one way to reduce potential distractions.

I found another important recommendation searching the Internet. It was in an article written by Ken Steiner posted on the San Carlos Airport Pilots Association Aviation Safety Page. In the article Steiner (the article said he was the Claims Manager and Assistant Vice President for the San Francisco office of the United States Aircraft Insurance Group and active in accident investigation) told of one accident that "...took place on a crystal clear, moonless night at a remote desert airport. Although visibility was otherwise excellent, witnesses described conditions as pitch black with no visible horizon. The 2,000-hour, instrument pilot took off from a lighted runway. Within half-a-mile of the runway departure end, the aircraft went into a 90 degree left bank. The left wing tip struck the ground causing the aircraft to cartwheel resulting in the destruction of the aircraft and two fatalities." Steiner said this was a classic black hole accident where, on a dark night visual references are limited or non-existent, a pilot must be able to transition from VFR conditions to instrument conditions in, as he said, a blink of an eye.

This accident illustrates the fact that night flight operations can be deadly immediately upon takeoff for the unprepared. Add in the risks en route, such as inadvertent flight into clouds or IMC and the possibilities of fog or other obstructions to vision at the landing airport, and you can begin to see that night flight requires extra preparation and planning. In one case involving a turbojet departing from the San Diego area several years ago, the pilot decided to pick up his instrument flight plan after takeoff. Departing visually at night, the aircraft hit a mountain top east of San Diego killing all onboard. The pilot failed to see and avoid the mountain top hidden in the "black hole" east of the city.

The risks are real. Preparation is the key to a successful flight. Another technique that can reduce night landing accidents is to know the published altitude of the field. Rather than depend upon your eyes alone in flying your approach, you should base your approach altitude upon that of the airfield. This is one way to minimize the visual affects of wide, narrow, or sloping runways. Another technique is to use all available approach lights, such as VASI and other runway lights. If the airport has pilot controlled lighting, be aware that the lights may switch off if you activated them early in your arrival process. You might want to key the activation code again on base to final or on final approach. The FAA *Airport/Facility Directory* (AFD) for the airport will tell you how to key the pilot controlled lighting. The AFD will also list what other flight aids will be available. For example, the Laurier, Washington, listing for Avey Field includes a remark that "Rwy marked with retroreflective devices." Examples for other airports include recommended night landing runways, types of warning lights, and the lack of lights. An important risk to consider at smaller airports is unlit towers. *Notices to Airmen* (NOTAM) may report those lighted towers near airports that are out of service. The best defense against all towers is to check your charts for any listed towers and to maintain your en route altitude as long as possible.

A final recommendation is to use all available navigation aids and information. Any type of glide path guide, whether electronic or visual, will keep you out of the trees at the end of the runway. If you have access to the latest approach procedure for the airport, the published data will provide altitude information throughout the approach. A through review of the AFD for the airport will also provide important information. A final check for any NOTAMs is important. You don't want to arrive at the airport expecting to use runway lighting, if the lights are out of service.

These are only a few safety recommendations for night operations. The key to having a safe flight is adequate preparation and a qualified, current, and rested pilot able to make good decisions. Have a safe season of night flying. Remember to file a flight plan if going VFR, and be careful when flying near black holes, you don't know what might be lurking there. What you don't know, can kill you.

Is Your Airplane IFR Legal?

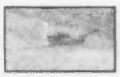
by H. Dean Chamberlain

How do you know? In today's GPS world, do you still think about using the VOR navigation system any more? Most IFR approved GPS systems installed today were approved under Technical Standard Order (TSO)-C129a for supplemental use. This supplement use limitation requires alternate navigation equipment to be available onboard the aircraft. As noted in the *Aeronautical Information Manual* (AIM), as long as your GPS uses RAIM for integrity monitoring, you don't have to be actively monitoring your alternate navigation equipment, but if you lose RAIM or if RAIM is predicted to be lost, you must use your alternate equipment. That other equipment might be your VOR. If you have VOR capability, and most airplanes that file instrument flight rules (IFR), probably have at least one onboard, when was the last time you checked its accuracy? More importantly, if you did check its accuracy, did you enter the required check correctly in a reliable record? Of if someone else made the entry, is it correct? If you rent the aircraft you fly, do you routinely check its paperwork for currency? No, I am not talking about the required 24-month checks for its transponder and static system, as appropriate. Nor am I talking about the annual inspection of its emergency locator transmitter (ELT), if so equipped. I am asking if you check that its annual inspection is current. Do you know if the aircraft has to have a 100-hour inspection? If so, is the 100-hour inspection current? Can a 100-hour inspection cover a 105 hour period? Is so, how? If the aircraft has an FAA-approved IFR GPS installed, does it have a current data base if you use it IFR? If so, was a proper record made of the data base installation? Finally, if the aircraft is legal, are you legal to be pilot in command?

These are important questions. I think most of us tend to forget the important issues involved in these questions. Obviously, flight safety is the most important. However, failure to properly record the results of these inspections can result in enforcement actions against the pilot in command for operating a non-airworthy airplane, as well as exposing the aircraft owner or operator to possible enforcement action as well as possible insurance problems in the event of an accident.

In researching the proper format for recording a VOR operational check, which is found in Title 14 Code of Federal Regulations (14 CFR) §91.171, VOR equipment check for IFR operations, I thought this would be a good time to review the VOR requirements for operating a civil aircraft under IFR using the VOR navigational system. In describing how a VOR system can be checked, subsection (2) of that regulation states, "Has been operationally checked within the preceding 30 days, and was found to be within the limits of the permissible indicated bearing error set forth in paragraph (b) or (c) of this section."

The rule then lists the permissible



errors. In summarizing those errors, at the departure airport using an approved radiated VOR test signal or designated ground test point, a maximum error of plus or minus four degrees. A maximum of plus or minus six degrees of error is permissible using an airborne procedure as outlined in the rule. Using the procedure outlined in the regulation for checking one independent VOR receiver against a second unit in the aircraft permits a maximum of plus or minus four degrees as acceptable. The regulation provides complete details for doing the respective type of tests. [The appropriate FAA *Airport/Facility Directory* for your area lists VOR receiver checkpoints and VOR Test Facilities (VOT) you can use for the checks.]

The key to your use of an aircraft using a VOR system for IFR flight is contained in subsection (d) of the rule. That subsection states in part, "Each person making the VOR operational check, as specified in paragraph (b) or (c) of this section, shall enter the date, place, bearing error, and sign the aircraft log or other record." If a test signal is used as part of the test, there is a record requirement for the test signal.

If there is an FAA-approved IFR GPS installed in the aircraft, do you know who is authorized to update the data base? Are you? Once the data base is updated, do you know how to check if the signoff was done correctly? If not, you might want to review 14 CFR part 43. The authority to update the GPS data base is contained in Appendix A to Part 43, Major alterations, major repairs, and preventive maintenance, subsection (c) Preventive maintenance (32). Subsection 32 says, "Updating self-contained, front instrument panel-mounted Air Traffic Control (ATC) navigational software data bases (excluding those of automatic flight control systems, transponders, and microwave frequency distance measuring equipment (DME)) provided no disassembly of the unit is required and pertinent instructions are provided. Prior to the unit's intended use, an operational check must be performed in accordance with applicable sections of part 91 of this chapter."

Part 43 explains who may conduct the operational check and how the results of that check must be recorded. The following are excerpts from part 43. Anyone interested in performing any of work outlined in part 43 must review the entire contents of the rule to ensure compliance. These excerpts are only intended to provide a quick overview of the rule. If you are a sport pilot or the work involves a light-sport category aircraft, you need to review the rules that apply to sport pilots or light-sport aircraft.

Q. Can a pilot perform preventive maintenance?

A. Yes. "The holder of a pilot certificate issued under Part 61 may perform preventive maintenance on any aircraft owned or operated by that pilot which is not used under Part 121, 129, or 135."

Q. What is involved in approving an aircraft for return to service after performing preventive maintenance?

A. Section 43.5, Approval for return to service after maintenance, preventive maintenance, rebuilding, or alteration, states in part, "No person may approve for return to service any aircraft, airframe, aircraft engine, propeller, or appliance, that has undergone maintenance, preventive maintenance, rebuilding, or alteration unless—

(a) The maintenance record entry required by Sec. 43.9 or Sec. 43.11, as appropriate, has been made."

Q. Who can approve an aircraft to return it to service?

A. Sec. 43.7,Persons authorized to approve aircraft, airframes, aircraft engines, propellers, appliances, or component parts for return to service after maintenance, preventive maintenance, rebuilding, or alteration, states in part, "A person holding at least a private pilot certificate may approve an aircraft for return to service after performing preventive maintenance under the provisions of Sec. 43.3(g)." Section 43.7(g) and (h) explain what sport pilots and holders of a repairman certificate (light-sport aircraft) with a maintenance rating may do concerning light-sport aircraft.

Q. What must the required record contain?

A. Sec. 43.9, Content, form, and disposition of maintenance, preventive maintenance, rebuilding, and alteration records (except inspections performed in accordance with part 91, part 123, part 125, Sec. 135.411(a)(1), and Sec. 135.419 of this chapter), states in part, (a) Maintenance record entries. Except as provided in paragraphs (b) and (c) of this section, each person who maintains, performs preventive maintenance, rebuilds, or alters an aircraft, airframe, aircraft engine, propeller, appliance, or component part shall make an entry in the maintenance record of that equipment containing the following information: (1) A description (or reference to data acceptable to the Administrator) of work performed. (2) The date of completion of the work performed. (3) The name of the person performing the work if other than the person specified in paragraph (a)(4) of this section. (4) If the work performed on the aircraft, airframe, aircraft engine, propeller, appliance, or component part has been performed satisfactorily, the signature, certificate number, and kind of certificate held by the person approving the work. The signature constitutes the approval for return to service only for the work performed.

Although the above information may be more than you wanted to read, the information provides the regulatory basis for performing the required operational checks for VOR and installing a data update to a GPS system.

For more information about all types of repairs, you should check the various appendixes to part 43 which define what are major repairs, major alterations, preventive maintenance, and the various types of inspections. Part 43 also provides definitions of the various types of maintenance and who is authorized to perform that maintenance. ✢

The FAA Safety Team Takes Aim at Aircraft Accidents

by Les Dorr, Jr.

On October 1, the Federal Aviation Administration (FAA) ushered in a new effort to help aircraft owners, pilots, and aviation maintenance technicians avoid mistakes that lead to accidents. Called the FAA Safety Team, or "FAASTeam" — the program is devoted to decreasing aircraft accidents by promoting a cultural change in the aviation community toward a higher level of safety.

The Team uses a coordinated effort to focus resources on particularly elusive accident causes. The program features data mining and analysis, teamwork, instruction in the use of safety management systems and risk management tools, and development and distribution of educational materials.

Safety in the Numbers

There's plenty of data available on aircraft accidents, but it's often difficult to determine exactly what the data says should be done to reduce accidents. The FAASTeam is developing a Web-based "Data Mart" specifically to give each FAASTeam program manager the correct data for his or her geographic area. This will include accident data for airmen who live in one area, but actually had an accident in another area.

This is an important new concept. Previously, accident data was summarized by where the accidents occurred. Programs to address those accident causes were developed and delivered in that area — but many airmen who had the problem, and others like them, were not there to receive it. The FAASTeam will reach these airmen on their home turf, not in the area of the accident site.

FAASTeam program managers are being trained to analyze the data and extract system and human factors problems. The issues identified will be combined with information from local FAA inspectors who certify and perform surveillance on airmen and air operators. Together, the data and information becomes the program manager's "source data." They will use source data to develop topics and tasks that will be woven into an annual plan of action.

Regional FAASTeam managers will coordinate and prioritize the actions of their program managers into a cohesive and efficient regional plan. All this effort is designed to make sure resources are devoted to activities that will have the biggest impact on the safety culture and accident rate.

The "Team" in FAASTeam

Teamwork will allow the FAA to multiply its efforts beyond what the program managers can do alone. The FAASTeam will develop symbiotic relationships with individuals and industry groups that have a vested interest in aviation safety. These individuals, called FAASTeam representatives, will work closely with the program managers to deliver our safety message to airmen on a local level. The coordinated effort of all these FAASTeam members is what will cause the safety culture to tip in the right direction.

Grassroots System Safety

The FAASTeam will bring the concept of system safety to segments of the aviation community that have not experienced it before. Aviation operators such as flight/mechanic schools and repair stations identified to have higher risk levels will be provided with training on how to develop their own safety management systems, including the tools necessary to set up their own system. The FAASTeam will provide risk management training and tools to individual airmen and organizations via live seminars conducted by FAASTeam Members and online training found on the FAASTeam's Web application <FAASafety.gov>.

Innovation = Behavior Change

The Team is developing new products for airmen and air groups, focusing on showing airmen how they can change their behavior to be consistent with the new safety culture. Many of those products will be developed by working with industry FAASTeam members. Others will come from our National Resource Center, collocated with the FAA Production Studios in Lakeland, FL. This facility can take new product ideas from FAASTeam members and turn them into safety products in a variety of media, which can then be duplicated, stored, and shipped (or beamed via satellite) wherever needed.

Decades of Safety Advocacy

For more than 36 years, the FAA has had a program to improve aviation safety. The effort began as the Accident Prevention Program on June 30, 1970. That program introduced the concept of a joint effort sponsored by the FAA and the aviation community to reduce the aviation accident rate. Over the years, the endeavor evolved into the Aviation Safety Program, and convincingly demonstrated that the general aviation accident rate could be reduced. In the 1990s, the program expanded to include aviation maintenance technicians.

While highly successful, the Aviation Safety Program took a "shotgun" approach, educating airmen on all types of safety subjects that successfully reduced accidents in the past. But today, the easy-to-fix accident causes have all been addressed. The FAA has created the FAASTeam to take aviation safety one step further.

Les Dorr, Jr., is a Media Specialist in FAA's Office of Communications.

What's Up Doc?

by H. Dean Chamberlain

Not a very original way of getting someone's attention, but it worked for years for a famous cartoon character. But will it get the attention of someone entering the traffic pattern at your neighborhood non-towered airport on a busy Saturday afternoon?

I think not. The topic of how to communicate with your fellow aviator starts with your first day of flight training. The problem is how many pilots continue to use the FAA recommended communication procedures once they no longer are student pilots. I still have not found the phase "You were stepped on" in the *Aeronautical Information Manual* (AIM). However, if you are reviewing common phases used on Citizen Band (CB) radio, you will hear the phase frequently. The common usage of the phase means someone else was transmitting on the CB radio while you were trying to talk. The result is your transmission was disrupted to the point it was unintelligent to the person you were trying to communicate with. But, the reason I mentioned the phase "stepped on" is because I want to remind everyone trying to communicate on a radio or in person to listen before trying to talk. As Ray Stinchcomb, an aviation safety inspector (operations) here at FAA Headquarters said, "When people are talking, they are not listening. Someone who enters the traffic pattern and constantly announces the aircraft's position around the pattern may not be listening. It is one thing to announce your position, but it is also important to listen for other aircraft in the area about to enter the pattern and to give those other pilots a chance to talk."

Failure to listen on the designated frequency effectively "cuts off communication" when it is needed most. That need is greatest on a clear, visual flight rule day at a non-towered general aviation airport. This is the type of day when you are at the greatest risk of having a mid-air collision. Failure to effectively communicate could result in a deadly situation. It is important to remember that talking is not effective communication. Words must be heard, understood, and the desired action initiated before effective communication has taken place. However, there is one caveat. Not every aircraft has a radio onboard, and there is always the possibility that one that does have a radio onboard may have had a radio failure en route, and then there are always those few pilots in aircraft with radios that never turn the radios on.

"I tawt I taw a puddy tat. I did, I did see a puddy tat!"

This is why Tweety Bird's famous expression is so important. As outlined in Title 14 Code of Federal Regulations part 91, Right-of-way rules: except water operations, subsection 91.113(b) states in part, "General. When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft." All pilots have a responsibility to see and avoid other aircraft whether or not the aircraft involved have functioning radios. As Tweety Bird feared, the "puddy tat" he failed to see might be his demise. The same is true of the aircraft you fail to see when in visual conditions.

So what can be done? First, pilots can review the FAA recommended communication model in the AIM. Too much radio "chatter" is as bad as too little self-announcement. Second, we can all learn to listen. For example, if you monitor approach control, if one is available for your local airport, you can listen to its aircraft position reports to increase your situational awareness of nearby aircraft. In addition, you can monitor the designated airport frequency while inbound to get an idea of any aircraft in the pattern or inbound or outbound to the airport. Obviously, if someone is not talking, unless you see the aircraft you will not know it is there. That is why it is a good idea to transmit in the blind for anyone monitoring the common traffic advisory frequency (CTAF) when you are inbound to a non-towered airport. The key is not to transmit so much that other pilots cannot announce their positions and intentions.

AIM paragraph 4-1-9, Traffic Advisory Practices at Airports Without Operating Control Towers, says in subparagraph 4-1-9 (a)(1), "There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories."

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Dave Clemmer photo

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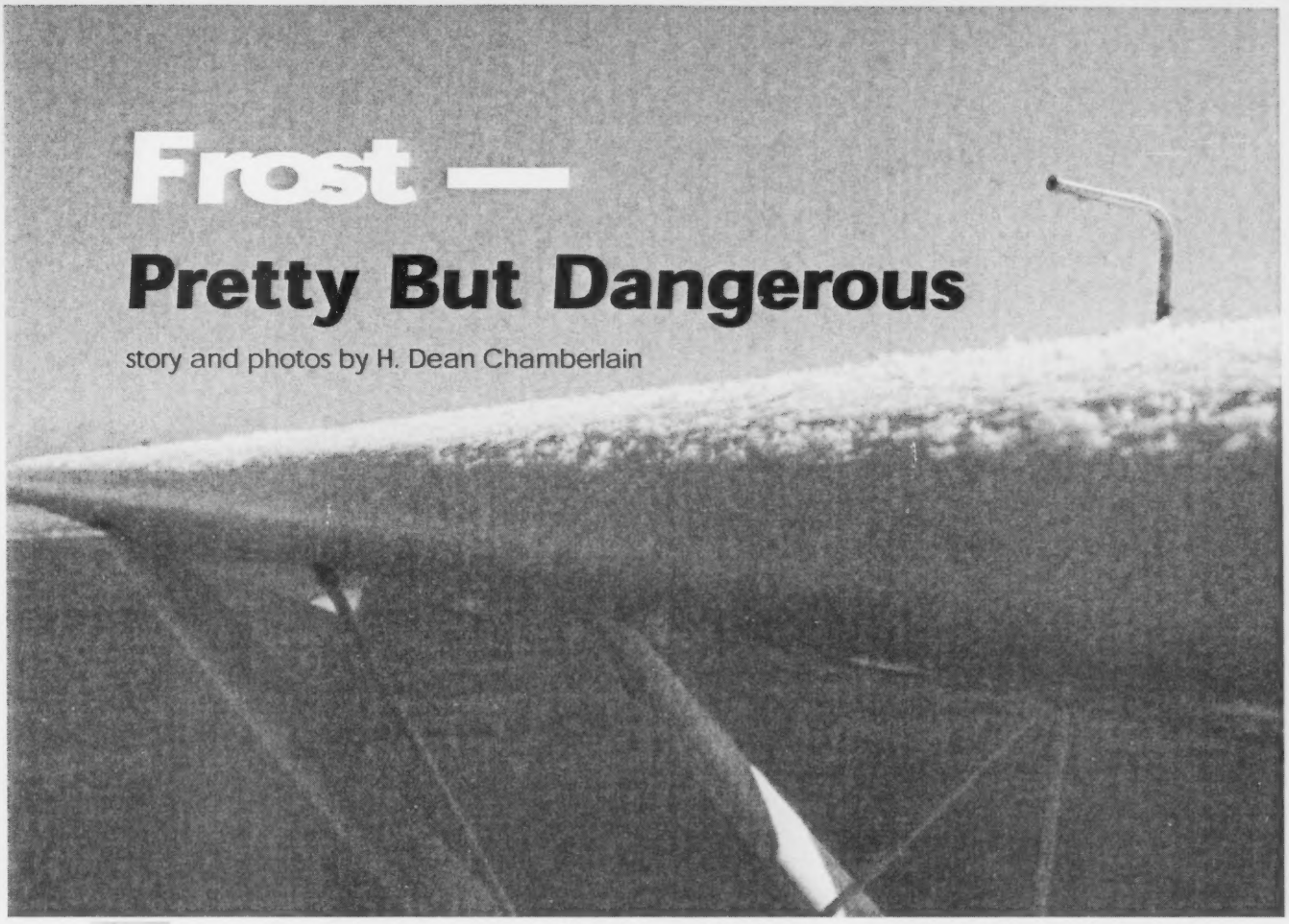
We have a limited number of back issues in stock. If you see an article from a past issue that you would like to receive, contact us at (202) 493-4958 or e-mail <louise.oertly@faa.gov>.

Frost —
Pretty But Dangerous

story and photos by H. Dean Chamberlain



Frost—it makes interesting patterns on windows, looks great on pumpkins, is hard to scrape off your car's windshield, and is potentially dangerous on your airplane. This is also the time of the year when you can expect to find frost or ice on your airplane.

The frost photographs in this article were taken in September 2006 at Truckee-Tahoe Airport in Truckee, California. I went to Truckee, elevation 5,900 feet mean sea level, hoping to take some ice or snow photographs to illustrate a winter safety article I wanted to include in this issue. As I drove west from Reno, Nevada, along Interstate 80 into the mountains, I realized the weather was not cooperating. I had hoped for snow like last year, but I quickly realized I was not going to find any. Frankly, the weather was just too nice. It was cold, but there was no chance of snow. But since I have yet to find an airport I didn't like, I drove to Truckee to see what I could find.

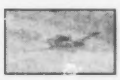
Imagine my surprise when I parked my car and saw a pilot, Clint Bazzill from El Granada, California, using the sun to remove frost from his white *Kitfox* airplane. As he worked on the aircraft, he would move the aircraft around to expose particular areas of it to the most direct rays of the sun. In talking to him, he was aware of the danger frost posed to his safe departure. He wanted a clean, dry aircraft.

Then to my surprise, I saw a large business jet, a Cessna 680, parked down the ramp. From the sounds I heard, either an engine or an auxiliary power unit was running on the jet. Seeing people walking around the aircraft, it was obvious the crew was preparing for a departure. As I watched, I saw an airport pickup truck drive up to the jet. A man took a tall stepladder off the truck and set it up near the tail of the aircraft. Then in a scene that would make the grumpiest FAA safety inspector happy, one of the men near the aircraft climbed the ladder to physically inspect the T-tailed horizontal stabilizer for frost. Some of the photographs in this article show that inspection.

I thought that crew was truly showing its professionalism as one of its members inspected the aircraft for frost. Frankly, it was not easy to do. The airport office had to be contacted. Someone had to go and get a ladder tall enough to reach the tail, and finally a crew member had to climb the ladder to check for frost and possibly ice.

If it had been your aircraft, would you have done it? Even if it was your typical low-wing Mark I family flyer, would you have walked around the aircraft to physically inspect and touch the aircraft's surfaces for contamination?

The sad thing is some crews have not physically checked their aircraft's



surfaces, and that failure has contributed to accidents. Surprisingly, according to one report I read, jet aircraft seem to be more susceptible to frost and wing contamination than some other types of aircraft. When I photographed the aircraft shown in this short article, it was my intention just to remind everyone of the need to check your aircraft for frost, ice, or snow. But as I started talking to people here at Headquarters about the article, several pointed out important safety material that I should review and consider adding to what at one point was going to be a short photo essay on the dangers of frost.

The first source is a September 2006 Safety Alert from the National Transportation Safety Board (NTSB) warning pilots of the dangers of aircraft icing. The Alert (SA-06) titled "Aircraft Icing," includes a subtitle that says, "Pilots urged to beware of aircraft upper wing surface ice accumulation before takeoff." The sidebar with this article is the complete text of the Alert.

Another good source of information I was told about is a NASA Internet Web site that has a video training course on it. The URL for the site is <http://aircrafticing.grc.nasa.gov/courses.html>. The NASA site has two video courses of benefit to general aviation pilots. The first is titled "A Pilot's Guide to Ground Icing." The second one is titled "A Pilot's Guide to In-Flight Icing." The NASA site also provides detailed resources for the courses as well as review material, media files, accident reports, and other icing related materials. NASA has done a lot of research on aircraft icing. You can find that information on its Web site <http://icebox.grc.nasa.gov>.

FAA has published many documents and advisory circulars (AC) on winter operations, such as frost, icing, freezing rain, and snow. Although much of that material addresses air carrier and commuter operations, the material provides important information for other types of flight operations as well. My initial FAA search returned 27 AC titles on the word "frost." In reviewing several of the ACs, one AC noted that "Most pilots are aware of the hazards of ice on the wings of an aircraft. The effects of a hard frost are much more subtle. This is due to an increased roughness of the surface texture of the upper wing and may cause up to a 10 percent increase in the airplane stall speed. It may also require additional speed to produce the lift necessary to become airborne." The AC, AC 61-84B, also said, "Once airborne, the airplane could have an insufficient margin of airspeed above stall such that gusts or turning of the aircraft could result in a stall."

AC 135-16, titled "Ground Deicing and Anti-Icing Training and Checking," was written for the Title 14 Code of Federal Regulations (14 CFR) part 135 community. However, the AC made several important points that all GA pilots can benefit from. The first is the "Clean Aircraft Concept." This summarizes regulatory guidance in 14 CFR parts 121 and 135 that says no person may takeoff an airplane when frost, ice, or snow is adhering to the wings, control surfaces, or propellers of the airplane. The AC states, "The rationale behind this concept is that the presence of even minute amounts of frost, ice, or snow (referred to as 'contamination') on particular airplane surfaces can cause a potentially dangerous degradation of airplane performance and unexpected changes in the airplane flight characteristics." The AC also defined ground icing conditions as any time conditions are such

Whether you fly a small kit-built aircraft such as this *Kitfox*, photo on the left, or a large turbojet, such as this Cessna, you need to inspect the aircraft for frozen surface contamination. If contamination is found such as frost, snow or ice, you need to follow the appropriate procedure for removing it.

that frost, ice, or snow may reasonably be expected to adhere to an airplane. The AC defined frost, including Hoarfrost, as a deposit of interlocking ice crystals formed by direct sublimation of water vapor on an object or aircraft surface, which is at or below 32 degrees Fahrenheit or 0 degrees Celsius.

What I found interesting in the AC was the statement that frost or ice can form on an aircraft's wing surfaces when the temperature is above freezing. Although we normally think of frost forming as a result of freezing temperatures at ground level, the AC said frost or ice can form on a wing when the wing is "cold-soaked" and encounters high humidity, rain, drizzle, or fog, even though ambient temperatures are above freezing. A good example of this is a cold aircraft landing from the sub-freezing temperature of high altitude down through the above weather conditions. The aircraft could experience frost or ice forming on its surfaces. The AC also said cold-soaked fuel can also cause frost to form over the fuel tank areas in the above conditions.

AC 135-16 highlighted an important safety point. In its detailed section dealing with deicing and anti-icing fluids and the proper way to apply and use them, the AC said, "Some fluids may not be compatible with aircraft materials and finishes and, some may have characteristics that impair aircraft performance and flight characteristics or cause control surface instabilities. Use of automotive antifreeze for deicing is not approved. Its holdover time and its effects on aircraft aerodynamic performance are generally unknown." The AC lists several ways to deice an aircraft including several good references regarding winter operations. For your smaller GA type aircraft, one of the best ways is a heated hangar. Regardless of how you remove frost, ice, or snow from your aircraft, be it heat from the sun, deicing fluid, scrapping, or another method that works for you, a critical element is to ensure that the contamination does not refreeze back on your aircraft. This is especially true on a critical control surface or operating area such as a control hinge that might prevent the operation of that control surface.

Failure to properly check for any surface contamination such as frost, snow, or ice and to properly remove that contamination could result in you becoming a test pilot in an aircraft that might not be able to fly.

Have a safe winter.

NTSB SAFETY ALERT

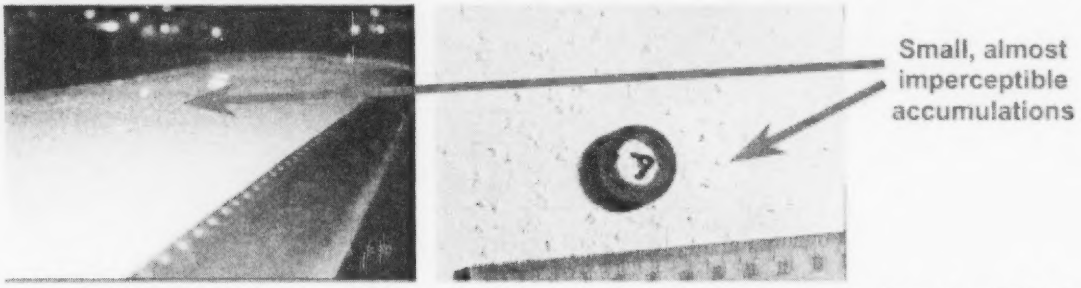
National Transportation Safety Board

★Aircraft Icing

Pilots urged to beware of aircraft upper wing surface ice accumulation before takeoff

The problem:

- Fine particles of frost or ice, the size of a grain of table salt and distributed as sparsely as one per square centimeter over and airplane wing's upper surface, can destroy enough lift to prevent a plane from taking off.
- Almost virtually imperceptible amounts of ice on an aircraft wing's upper surface during takeoff can result in significant performance degradation.
- Small, almost visually imperceptible amounts of ice distributed on an airplane's wing upper surface cause the same aerodynamic penalties as much larger (and more visible) ice accumulations.



- Small patches of ice or frost can result in localized, asymmetrical stalls on the wing, which can result in roll control problems during lift off.
- It is nearly impossible to determine by observation whether a wing is wet or has a thin film of ice. A very thin film of ice or frost will degrade the aerodynamic performance of any airplane.
- Ice accumulation on the wing upper surface may be very difficult to detect from the cockpit, cabin, or front and back of the wing because it is clear/white.
- Accident history shows that nonslatted, turbojet, transport-category airplanes have been involved in a disproportionate number of takeoff accidents where undetected upper wing ice contamination has been cited as the probable cause or sole contributing factor.
- Most pilots understand that visible ice contamination on a wing can cause severe aerodynamic and control penalties, but it is apparent that many pilots do not recognize that minute amounts of ice adhering to a wing can result in similar penalties.
- Despite evidence to the contrary, these beliefs may still exist because many pilots have seen their aircraft operate with large amounts of ice adhering to the leading edges (including the dramatic double horn accretion) and consider a thin layer of ice or frost on the wing upper surface to be more benign.

What should pilots know and do to fly safely in icing conditions?

- Pilots should be aware that no amount of snow, ice or frost accumulation on the wing upper surface should be considered safe for takeoff. It is critically important to ensure, by any means necessary, that the upper wing surface is clear of contamination before takeoff.
- The NTSB believes strongly that the only way to ensure that the wing is free from critical contamination is to touch it.
- With a careful and thorough preflight inspection, including tactile inspections and proper and liberal use of deicing processes and techniques, airplanes can be operated safely in spite of the adversities encountered during winter months.
- Pilot should be aware that even with the wing inspection light, the observation of a wing from a 30- to 40-foot distance, through a window that was probably wet from precipitation, does not constitute a careful examination.
- Pilots may observe what they perceive to be an insignificant amount of ice on the airplane's surface and be unaware that they may still be at risk because of reduced stall margins resulting from icing-related degraded airplane performance.
- Depending on the airplane's design (size, high wing, low wing, etc.) and the environmental and lighting conditions (wet wings, dark night, dim lights, etc.) it may be difficult for a pilot to see frost, snow and rime ice on the upper wing surface from the ground or through the cockpit or other windows.
- Frost, snow, and rime ice may be very difficult to detect on a white upper wing surface and clear ice can be difficult to detect on an upper wing surface of any color.
- Many pilots may believe that if they have sufficient engine power available, they can simply "power through" any performance degradation that might result from almost imperceptible amounts of upper wing surface ice accumulation. However, engine power will not prevent a stall and loss of control at lift off, where the highest angles of attack are normally achieved.
- Some pilots believe that if they cannot see ice or frost on the wing from a distance, or maybe through a cockpit or cabin window, it must not be there – or if it is there and they cannot see it under those circumstances, then the accumulation must be too minute to be of any consequence.

Need more information?

- Crash During Takeoff in Icing Conditions, Canadair, Ltd., CL-600-2A12, N873G, Montrose, CO, November 28, 2004. Aircraft Accident Report NTSB/AAB-06/03: www.ntsb.gov/publictn/2006/AAB0603.htm
- Epps Air Service, Challenger 604, Birmingham International Airport, Birmingham, UK, January 4, 2002. Air Accidents Branch (AAIB), Department of Transport, UK. Aircraft Accident Report 5/2004 (EW/C2002/1/2): www.aaib.gov.uk/cms_resources/dft_avsafety_pdf_030576.pdf
- NTSB recommendation letter issued as a result of 26 Cessna 208 icing-related incidents and accidents: www.ntsb.gov/Recs/letters/2004/A04_64_67.pdf
- Takeoff Stall in Icing Conditions, USAir flight 405, Fokker F-28, N485US, LaGuardia Airport, Flushing, NY, March 22, 1992. Aircraft Accident Report NTSB/AAR-93-02: www.ntsb.gov/ntsb/brief.asp?ev_id=20001211X14270&key=1
- Ryan International Airlines, DC-9-15, N565PC, Loss of Control on Takeoff, Cleveland-Hopkins International Airport, Cleveland, OH, February 17, 1991. Aircraft Accident Report NTSB/AAR-91/09: www.ntsb.gov/ntsb/brief.asp?ev_id=20001212X16434&key=1
- Crash During Takeoff in Icing Conditions, Continental Airlines, DC-9-14, N26TX, Stapleton International Airport, Denver, CO, November 15, 1987. Aircraft Accident Report NTSB AAR-88/09: www.ntsb.gov/publictn/1988/AAR8809.htm
- NTSB website: www.ntsb.gov
- NTSB Most Wanted List: www.ntsb.gov/Recs/mostwanted/air_ice.htm

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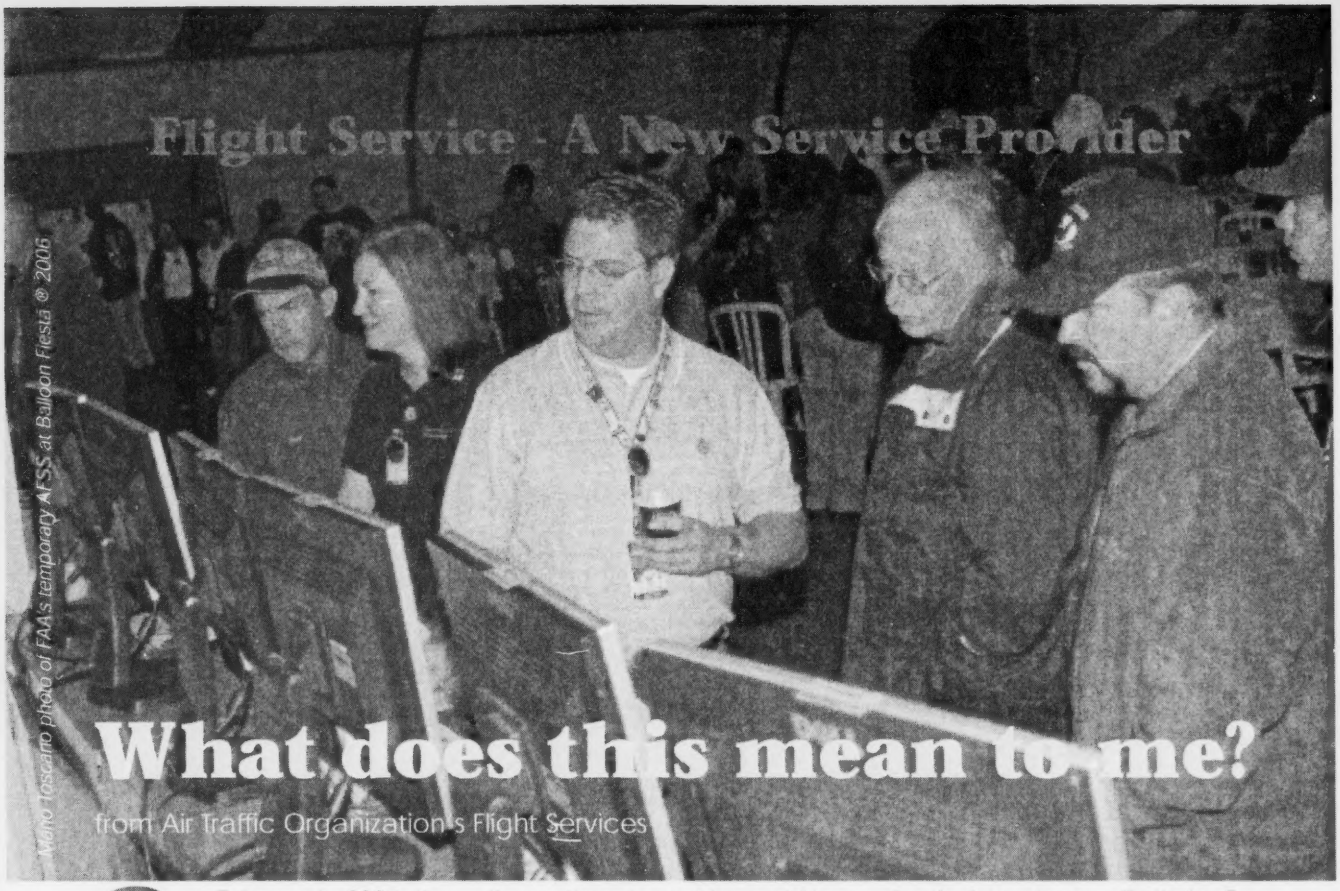


Mario Iosacro photo of FAA's temporary AFSS at Balloon Fiesta © 2006

What does this mean to me?

from Air Traffic Organization's Flight Services

On February 1, 2005, the FAA awarded Lockheed Martin Corporation (LM) a contract to perform flight services in 58 Automated Flight Service Stations (AFSS) in the lower 48 states, Hawaii, and Puerto Rico. The AFSS Contract was a result of a public/private competition following OMB Circular A-76 guidelines. The scope of the public/private competition did not include flight services delivered in Alaska. A little over one year ago, on October 4, 2005, LM assumed responsibility to deliver flight services to the flying public.

Should I have noticed a difference? Not really. Services continue to be provided from 58 AFSSs in the Continental U.S., Hawaii, and Puerto Rico. The change in service provider should be transparent to the user, as LM staffed all the AFSSs with incumbent employees and continued to provide flight services following the same policies and procedures used by the FAA on October 3, 2005.

The FAA Flight Service Organization continues to provide oversight on all flight services delivered to the flying public. The contract with LM is a performance-based service contract that establishes verifiable Acceptable Performance Levels (APLs). APLs are metrics (21 total) established to enable the government to measure contractor performance. These metrics are backed up with financial incentives and penalties. The process for collection, measurement, and analysis of APLs is governed by a Quality Assurance Surveillance Plan (QASP) as executed through a Quality Assurance Evaluator (QAE) organization.

LM is expected to make system improvements by implementing a new suite of equipment, Flight Services 21 (FS21), providing information to flight service specialists and pilots. The FS21 system includes a new network enabled voice communication suite and integrated hardware and software automation tools. LM's last site in the integration plan is expected during the fourth quarter of fiscal year 2007 (July-August time-frame). FS21 will also utilize the Internet more effectively. For the first time, Internet users and briefers will be able to see the same information.

Over a 36-month transition period that started October 2005, LM will consolidate the services provided by the existing 58 sites into three new Hubs (located in Leesburg, Virginia, Ft. Worth, Texas, and Prescott, Arizona) and 17 refurbished existing facilities.

How are they doing? LM is now online with a new Web site: <www.afss.com>. You can provide feedback directly to them on the services they are providing by registering on the site.

FAA's Flight Service Organization is now online at <http://www.faa.gov/about/office_org/headquarters_offices/ato/so/fs/>. You can find information on Flight Services today, the background of the AFSS contract, links to helpful sites, and a direct feedback link to both LM and the FAA.

Look for additional information on the upcoming transition in a future issue of *FAA Aviation News*.

'Tis the Season

by Salvatore Scalone

This article was written before September 11, 2001, and published in the November/December 2001 issue of FAA Aviation News. *The author asked if we could reprint it, as "people still remember that holiday article and it continues to add a little more to the holiday spirit, especially for those who are in our business." —Editor*

In the field of aviation our past includes two extraordinary brothers who demonstrated that powered, controlled flight was possible. On December 17, 1903, at Kitty Hawk, North Carolina, Wilber and Orville Wright made history. Their first controlled, sustained flight lasted twelve seconds and covered approximately 120 feet in a heavier-than-air craft. That same day these famous brothers made three more flights with each flight extending the time and distance flown. The last flight of the day carried Wilber 852 feet and lasted 59 seconds. As inventors, builders, and flyers they further developed the "aeroplane," taught men to fly, and opened the era of aviation.

By 1914, airplanes became one of the more valuable tools of World War I. When the war ended in 1918, the U.S. Government found an important peacetime role for aviation—delivering mail. The U.S. Army initiated an experimental mail service program in May 1918. Within months, airmail service became the domain of the U.S. Post Office Department. In 1925 the Air Mail Act was passed making the carriage of mail by air a private operation under a system of competitive bidding.

Several entrepreneurs started the commercial aviation business in the late 1920's and early 1930's. Daring businessmen like Pan Am's Juan Trippe, United's Walter Varney, and American's Cyrus Smith were able to use these great heavier than air flying machines to carry mail. Later, this business expanded to include cargo and passengers. As the fledgling air carriers grew, it became apparent that aircraft had great potential and could produce enormous revenues, but they also carried substantial risk. After all, these early aircraft were not developed with the technology we have today and were not built or operated with safety as a priority.

The commercial air transportation business has evolved over the years producing aircraft to satisfy customer and business needs. Larger, faster, more reliable, more efficient, economical, and comfortable aircraft continue to be produced by aircraft manufacturers. However, because of the inherent danger, especially in the early aircraft, concerns over safety became an important part of this transportation evolution. Early aircraft were simply not well-constructed and had numerous mechanical failures. Aircraft

One of the early air carriers that also provided a flight attendant. She had to be a nurse to qualify, and was also considered excess baggage if the pilot determined that the airplane was overweight.

safety issues actually date back to 1908 when Orville Wright brought the Flyer to Ft. Myers, Virginia, (see photo on page 29) and won a military contract for the world's first military aircraft. Later that year his plane experienced a propeller failure and crashed, seriously injuring him and killing his passenger. It was these concerns in the early years of aviation that helped establish the priority of "safety first" as a standard for this industry. People were willing to accept this "new" form of transportation, but wanted assurances that it was safe to fly.

In the United States this on going evolution has created a unique safety-related partnership between the air carriers, manufacturers, and regulatory authorities. It is this partnership that has formed the basis for the rapid advances we have experienced in aircraft design, manufacture, inspection, maintenance, and aircraft operation. Additionally, these advances helped gain the confidence of the government and the general public. In a continuous working relationship these three great forces combined business needs with the latest technology in a framework of safety. This unique and successful partnership has become the envy of the world.

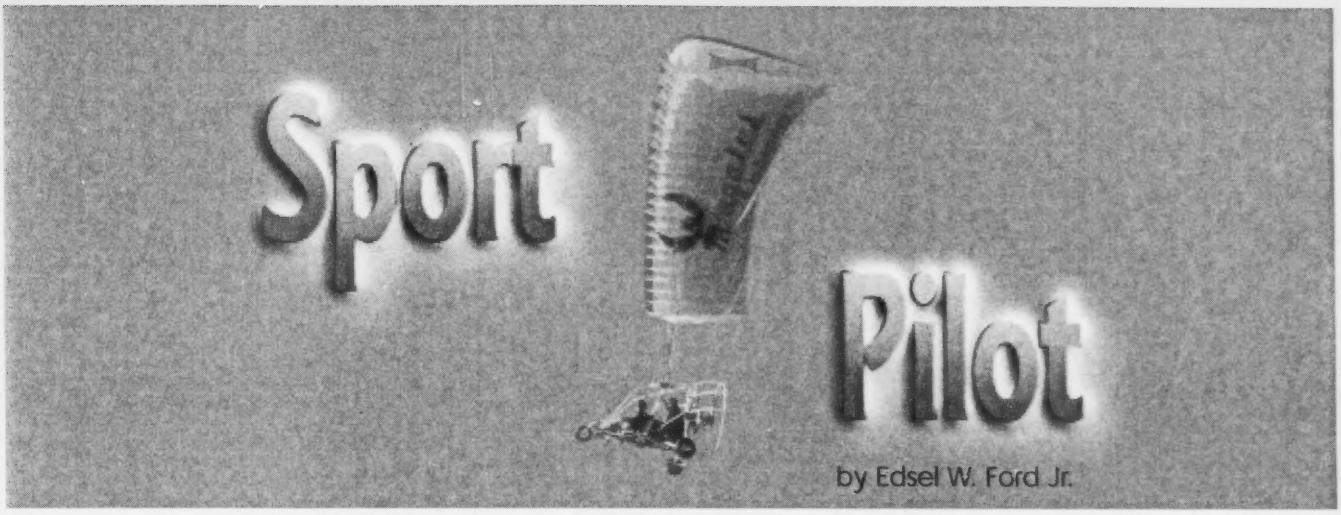
However, occasionally we are reminded that even with the success of building bigger, better, and safer aircraft, these great flying machines still carry risk. Until we are able to manufacture aircraft that are completely risk free, we must continue to rely on the standard we established for ourselves. This standard provides for the protection of life by making safety the single most important priority in our commercial air transportation system—a priority that must not and can not be affected by business cycles or issues of profit or loss.

The United States of America has the largest and safest commercial air transportation system in the world. Additionally, we build and operate some of the largest and safest aircraft for both passenger and cargo transportation. Air transportation has become one of the primary strengths of this country providing numerous services for passengers and cargo and steady employment for millions of Americans. It has also helped build and strengthen the economies of other countries around the world. We discovered this method of transportation, set the pace for its growth, and developed the standard necessary to make it safe and keep it safe. All this we shared with the world.

We have come a long way since that first successful flight at Kitty Hawk. In just over one hundred years what started as an experiment has progressed as an important part of our culture. Today the skies are filled with aircraft leaving and arriving at airports around the world, carrying millions of people and tons of cargo to almost every point on the globe.

During this Holiday season, let's take a moment to thank those individuals who contributed to the growth of our air transportation system. Those hard working men and women who helped build the foundation of the commercial aviation business have given us the tools we need to continue the progress and growth we have enjoyed. They have earned an important place in our history and deserve to be remembered.

Salvatore Scalone is the Manager of the Farmingdale (NY) Flight Standards District Office.



Maintenance and Modification of Light-Sport Aircraft

Maintenance is one of the less glamorous facets of aviation, but it is one of the most important. This is no different in the sport pilot arena. The goal of this ongoing series of articles is to provide you with information about different areas important to this still very young community. This article covers the area of maintenance and modification.

There are two ways of certifying a light-sport aircraft. It can be certified as either a special light-sport aircraft (SLSA) or as an experimental light-sport aircraft (ELSA). Each is certified under different sections of Title 14 Code of Regulations (14 CFR) part 21, and therefore have different maintenance and modification procedures.

The following excerpts highlight regulations that differentiate the two types of light sport aircraft. Depending on how your light-sport aircraft is certified, you could face very different maintenance requirements. The information to follow starts with a short explanation of what each of those certifications is and lists applicable regulations covering maintenance and modification. As always with regulation issues, the regulations listed here are up to date at the time this article was written, but for current regulations you should check the Web at <www.gpoaccess.gov/ ecfr> under Title 14, Aeronautics and Space, parts 21 and 91, sections cited later in the text.

Title 14 Code of Federal Regulations (14 CFR) §21.190, Issue of a special airworthiness certificate for a light-sport category aircraft, is the industry developed consensus standards and is the basis for certification and complied with by the manufacturer. Compliance is recorded and submitted on the FAA form 8130-15 "Statement of Compliance." The maintenance and modification requirements are given in the applicable sections of 14 CFR parts 43 and 91. For a light-sport category aircraft, it is found in §91.327. The maintenance and inspection requirements for aircraft are usually in §91.400s, so §91.327 is not a typical place where mechanics and operators would look. In addition, the operating limitations that are issued with the special airworthiness certificate have maintenance and inspection requirements. The highlighted areas are the requirements for modification of a "special light-sport aircraft." These modification requirements are different from what the mechanic and operator have complied with in the past. They place the manufacturer in control of any modification or repair beyond the scope and detail of the maintenance manual. The modification or repair is authorized by the manufacturer, and a letter from the manufacturer must be included in the aircraft records.

14 CFR Section 91.327

Aircraft having a special airworthiness certificate in the light-sport category: Operating limitations.

(b) No person may operate an aircraft that has a special airworthiness certificate in the light-sport category unless-

(1) The aircraft is maintained by a certificated repairman with a light-sport aircraft maintenance rating, an appropriately rated mechanic, or an appropriately rated repair station in accordance with the applicable provisions of part 43 of this chapter and maintenance and inspection procedures developed by the aircraft manufacturer or a person acceptable to the FAA;

(2) A condition inspection is performed once every 12 calendar months by a certificated repairman (light-sport aircraft) with a maintenance rating, an appropriately rated mechanic, or an appropriately rated repair station in accordance with inspection procedures developed by the aircraft manufacturer or a person acceptable to the FAA;

(3) The owner or operator complies with all applicable airworthiness directives;

(4) The owner or operator complies with each safety directive applicable to the aircraft that corrects an existing unsafe condition. In lieu of complying with a safety directive an

owner or operator may-

(i) Correct the unsafe condition in a manner different from that specified in the safety directive provided the person issuing the directive concurs with the action; or

(ii) Obtain an FAA waiver from the provisions of the safety directive based on a conclusion that the safety directive was issued without adhering to the applicable consensus standard;

(5) Each alteration accomplished after the aircraft's date of manufacture meets the applicable and current consensus standard and has been authorized by either the manufacturer or a person acceptable to the FAA;

(6) Each major alteration to an aircraft product produced under a consensus standard is authorized, performed and inspected in accordance with maintenance and inspection procedures developed by the manufacturer or a person acceptable to the FAA; and

(7) The owner or operator complies with the requirements for the recording of major repairs and major alterations performed on type-certificated products in accordance with §43.9 (d) of this chapter, and with the retention requirements in §91.417.

(c) No person may operate an aircraft issued a special airworthiness certificate in the light-sport category to tow a glider or unpowered ultralight vehicle for compensation or hire or conduct flight training for compensation or hire in an aircraft which that persons provides unless within the preceding 100 hours of time in service the aircraft has-

(1) Been inspected by a certificated repairman with a light-sport aircraft maintenance rating, an appropriately rated mechanic, or an appropriately rated repair station in accordance with inspection procedures developed by the aircraft manufacturer or a person acceptable to the FAA and been approved for return to service in accordance with part 43 of this chapter; or

(2) Received an inspection for the issuance of an airworthiness certificate in accordance with part 21 of this chapter.

(d) Each person operating an aircraft issued a special airworthiness certificate in the light-sport category must operate the aircraft in accordance with the aircraft's operating instructions, including any provisions for necessary operating equipment specified in the aircraft's equipment list.

Experimental light-sport aircraft (ELSA) are certificated under 14 CFR §21.191 and have three options to qualify under. The maintenance requirements of part 43 are not applicable to aircraft issued airworthiness certificates under §21.191(i)(1) and (2). However, §43.1(b) states, "this part does not apply to any aircraft for which the FAA has issued an experimental certificate, unless the FAA has previously issued a different kind of airworthiness certificate for that aircraft." This is referring to the SLSA that has been converted to an ELSA. The FAA has issued a previous certificate, so part 43 would still apply. However, the maintenance requirements of §91.237 would not apply. Aircraft having experimental airworthiness certificates are covered under §91.319 and the operating limitations issued to the aircraft.

14 CFR Section 21.191

Experimental certificates.

Experimental certificates are issued for the following purposes:

[Note: The experimental certificate is not a category but a purpose of operation.]

(i) Operating light-sport aircraft. Operating a light-sport aircraft that-

(1) Has not been issued a U.S. or foreign airworthiness certificate and does not meet the provisions of §103.1 of this chapter. An experimental certificate will not be issued under this paragraph for these aircraft after January 31, 2008;

[Note: This option is for the aircraft the FAA has been calling the "existing fleet." However, this can be applied to any aircraft that meets the definition of light-sport even if the aircraft would typically be amateur built.]

(2) Has been assembled-

(i) From an aircraft kit for which the applicant can provide the information required by §21.193 (e); and

(ii) In accordance with manufacturer's assembly instructions that meet an applicable consensus standard; or

[Note: This option is not available at the time of this writing. The kit consensus standards are just now complete but have not been accepted by the FAA. When you look up the dictionary definition of a kit, it says a box of parts that assembled into an aircraft would be defined as a kit. However, in the case of light-sport, the kit is required to have a kit statement of compliance and be a bolt for bolt copy of a special light-sport aircraft at the time of original certification. A box of parts today that is assembled into an aircraft would be considered to be part of the existing fleet. Modification of the "light-sport kit" aircraft can be at will after original certification.]

3) Has been previously issued a special airworthiness certificate in the light-sport category under §21.190.]

[Note: This option is for the special light-sport that no longer meets the consensus standards and the manufacturer's statement of compliance. This aircraft can be modified at will and then certificated as experimental. The only way that this aircraft can be converted back to a special light-sport aircraft is for the manufacturer to issue a new statement of compliance.

The maintenance and modification of light-sport aircraft has changed the method with which a mechanic or repairman should approach the job. There are many new things to learn as the industry delivers more aircraft to the market. Also, the number of experimental certificated aircraft that will be added to the general aviation fleet will present mechanics and repairmen alike with new challenges.

Edsel W. Ford, Jr., is an Aviation Safety Inspector with Flight Standards Service's Light Sport Aviation Branch, AFS-610.

Mario Toscano photo

Meet our New Writer, James Williams

My first introduction to the world of aviation was around the time I was 10 years old, when my father decided to get his private pilot's certificate. That first ride could have gone better (I had bit of motion sickness), but it did spark an interest. I next had a chance to fly at age 12 with an instructor in a Cessna *Cardinal*. Looking back, the one event that really turned me toward aviation as a career happened when I was 15; flying with my father from Gaithersburg, Maryland, to Yellowstone National Park. The park was great, but what really stays with me was the cross-country journey there and back. While I didn't fly again until college, I knew I wanted to be in the aviation industry.

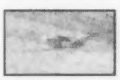
When the time came to look at colleges, I knew it was going to be a tough choice. There are many very good programs out there. I narrowed my choices down to three programs that I felt were the best. In the end it was a very tough decision. The Florida Institute of Technology, College of Aeronautics, in Melbourne, Florida, was my pick for two major reasons. First, it was a smaller university where I would get to know my professors and peers. Second, the weather in Florida sure beats that of the far north. Even weathering a few hurricanes hasn't changed my opinion on that. There's something very wonderful about studying at the beach in January in shorts and a T-shirt.

While pursuing a degree in Aviation Management, I earned my private pilot certificate and instrument rating. My course work consisted of a good mix of aviation and business. I studied everything from airport design to economics. With my private pilot certificate earned, I joined the Florida Tech Flight Team. During my four regional and three national competitions with the team, we flew from Melbourne, Florida, to Grand Forks, North Dakota; Columbus, Ohio; and Grenada, Mississippi, among other places. The competitions were fun and terrifying all at the same time. Between the long distances traveled to competition and the actual events, there are always good stories produced. Looking back now with more experience and wisdom, we probably made some mistakes, but I learned a lot and I'm sure it's made me a better pilot.

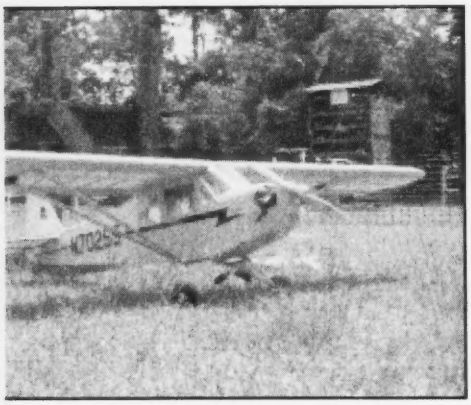
After graduation I began working on a Masters Degree in Applied Aviation Safety. The course work included classes in human factors, accident investigation, physiology, and other topics. That work gave me a chance to examine a few of the issues facing the industry today. From how to display weather information in the cockpit for pilots to the presentation methods of any possible Air Traffic Control Data link system. These are just a couple of the multitude of issues that face everyone in the aviation industry. While many advancements are first seen in military or high end civilian aircraft (such as Glass cockpits, composite construction, GPS, etc.) they have rarely been available to the average general aviation user. This latest boom of technology is finally catching up with us in the rest of the aviation industry. That makes right now an exciting time to be in this business. Safety is even more important in these times of rapid change.

When it came to looking for work, it's hard when you don't have an exact job title like accountant, engineer, or computer analyst. One of my professors had worked for the FAA and suggested I check and see what opening they had. After a couple of searches I found several possible positions that looked interesting. So I began the process of applying to the government which, if you've never had the pleasure, is not exactly the most enjoyable experience ever. The one thing that drew me to the FAA was a chance to work for an organization that leads and directs the entire industry and a chance to have a real effect on the safety record.

Joining the magazine staff will allow me to continue research into safety issues and hopefully to aid the flying public. I think my background as a general aviation pilot and experience in safety and human factors will help me find crucial issues to address. My goal here is to provide you, our readers, with information that is useful, current, and that adds to the overall safety and enjoyment of your flights.



• September/October's Back Cover



Editor's Note: In our last issue, we ran a photo on the back cover and asked if anyone could identify the airplane. It certainly generated some interesting answers.

Answer to your back cover question—is this a trick question? It's a 1948 J-3 Piper *Cub*. Data base shows it is registered to Aaron Mills of Rochester, NY.

Allen

FAA AVIATION NEWS welcomes comments. We may edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses may not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Readers are reminded that questions dealing with immediate FAA operational issues should be referred to their local Flight Standards District Office or Air Traffic facility. Send letters to H. Dean Chamberlain, Editor, FAA AVIATION NEWS, AFS-805, 800 Independence Ave., SW, Washington, DC 20591, or FAX them to (202) 267-9463; e-mail address:

Dean.Chamberlain@faa.gov

This is a very good photograph of a scale model J-3 Piper *Cub*. It looks like a full flight control radio control model. The giveaway was the wood prop and Mylar wing cover. By the way, the builder of the aircraft picked a good "N" number, at least as of today 10/2/2006, in the data base. I thought possibly it might have been an aircraft the modeler either owned or once flew and the "N" number still existed.

Thanks, read *FAA Aviation News* all the time.

Jim

It's a scale model, probably RC, of a J-3, with a four stroke model engine. How many people do you reckon will not look closely at the picture, look up the "N" number, and tell you it's a J-3 owned by Aaron Mills? Give us something a little more challenging next time.

Al

The photo appears to be a RC scale Piper *Cub*, possibly a Great Planes Model. The *Cub*'s engine is a Saito four cycle glow engine.

Very nice model.

Frank

The aircraft on the back cover of the September/October 2006 is a J-3C Piper *Cub*.

Steve

We want to thank everyone who submitted comments about the photo. To answer our first responder; yes, it was a trick question. The following is the explanation provided by the builder

The aircraft in the FAA Aviation News *photo is a Radio Control model. It is a Piper J-3* Cub *assembled from a Great Planes® kit. It has a wing span of 80 inches and has a Saito® .90 twin cylinder engine to more closely represent a full scale* Cub. *The "N" number was changed from the supplied number to the pictured number since I learned to fly (and later instructed) in N70255.*

• Not a Derrick

I must commend you and your staff for another outstanding issue of *Aviation News*. However the photograph on the top right-hand corner of page 7 is not captioned correctly. We, out there in the oil patch, would call the incorrectly captioned picture a "steel cowboy doing' the watusi," correctly named a pump jack.

A derrick is the high steel tower for the drilling apparatus. The derrick precedes the pump jack.

Thomas J. Forchtner

Former "Wildcatter"

Thanks for keeping us Beltway folks in line. I'll rope the culprit and inform him of the mistake.

• Kudos on "No Going Back"

Just wanted to say great article in the July/August issue. When speaking of the new integrated avionics systems in the context of training, I have often referred to raw data skills becoming a lost art. You're right on the money. Like you, I was trained in, and have flown, conventionally-equipped aircraft for many years. I also share the same enthusiasm when it comes to the new glass systems and love the tremendous amount of information provided by them. I myself am finding it hard to "go back," having flown with the enhanced situational awareness, traffic, weather, etc., of the newer systems. But with these tremendous capabilities comes even greater responsibility. I think your article will help bring this to the fore and maybe validate the point for some pilots who might have known it all along, but couldn't quite associate their gut feeling with a tangible concept.

Thanks again for the great insight.

Fred Zanegood

via the Internet

NEW SECRETARY OF TRANSPORTATION MARY E. PETERS SWORN IN

On Tuesday October 17, Mary E. Peters was sworn in as the 15th Secretary of Transportation after being confirmed by the U.S. Senate on September 30. President George W. Bush was on hand to witness the ceremony along with other dignitaries.

Secretary Peters has more than 20 years experience in transportation in both the private and public sectors. In the private sector Peters was the national director for transportation policy and consulting at HDR, Inc., a major engineering firm. In the public sector she served from 1985 to 2001 in the Arizona Department of Transportation (ADOT). In 2001 she was appointed director of that agency.

In 2001 she was appointed by President Bush to lead the Federal Highway Administration (FHWA). In that position she placed special emphasis on finding new ways to pay for road and bridge construction, including innovative public-private partnerships that help build roads faster and at less expense.

Secretary Peters comes to DOT with an excellent track record and recognition in the transportation industry. She was named Most Influential Person in Arizona Transportation by the Arizona Business Journal and won 2004 National Woman of the Year Award from the Women's Transportation Seminar.

One of the key areas the Secretary targeted in her speech was modernizing America's transportation system. Peters vowed "...to find 21st century solutions for 21st century transportation problems."

The Department of Transportation has almost 60,000 employees and a $61.6 billion budget and is responsible for overseeing air, maritime and surface transportation.

U.S. AND CANADA SIGN LICENSING AGREEMENT

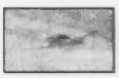
Flight Standards Director Jim Ballough, left, watches as Transport Canada's Director of Aircraft Maintenance and Manufacturing, Don Sherritt, signs the agreement.

The FAA and Transport Canada have signed an agreement that allows U.S. and Canadian pilots to obtain licenses and certificates from each other's countries. Private, Commercial, and Airline Transport Pilot certificates; and Single-engine land, Multi-engine-land, and Instrument ratings are covered by this agreement. Sea and Rotorcraft ratings are not yet available under this new procedure. By presenting their current certificates and logbooks and taking a short "air laws" differences test for the new certificate, U.S. pilots can obtain a stand alone Canadian license and vice versa.

This is a significant leap forward from the previous method under Title 14 Code of Federal Regulations (14 CFR) §61.75, Private pilot certificate issued on the basis of a foreign pilot license, which only allowed for granting a private certificate. Under 14 CFR §61.75 the certificate issued is based on the foreign pilot's license and is only valid so long as the foreign license has not expired, been revoked, or suspended. Under this new Implementation Procedure for Licensing, the certificate or license issued is a completely valid stand alone license. It is not dependent on the original license or certificate after issuance. Formerly this would mean that when a Canadian license would expire, the holder's U.S. certificate would become invalid, as it was based on that original license. Under the new procedure, that U.S. license would be a completely separate certificate, not requiring the holder to maintain Canadian certification.

This is the first such agreement ever to allow full privileges for foreign pilots between two countries without having to redo all or most of a pilot's training. Officials working on the program hope this is the first of many such agreements with other nations with similar standards of licensing.

This new Implementation Procedure for Licensing becomes effective December 6, 2006. We will have a full article on this procedure when the Advisory Circular is published outlining the process.



FAA SAFETY ORGANIZATION TAKES OFF WITH ISO 9001

On October 16, the Federal Aviation Administration's (FAA) Aviation Safety organization was recognized as the first federal agency to achieve certification to the prestigious International Organization for Standardization "ISO 9001:2000" quality management standard. This single corporate management system covers multiple services, including national and international sites.

At the ceremony, FAA Administrator Marion C. Blakey said, "...You're holding yourselves to the same standard that we require of the industry we serve. You're raising the bar for the rest of the federal government. You're showing that the FAA is the international standard for safety...."

The Aviation Safety organization began working toward ISO 9001:2000 registration in 2001 and now operates under a Quality Management System (QMS) that provides consistent, standardized processes that assure continual improvement, value employee contributions, and respond to changes in the industry.

As a global leader in aviation safety, the FAA is operating like an integrated business to ensure that each FAA safety office around the world provides consistent service and products to customers. It is vital that the government's aviation safety business is held to the same high standards as those it regulates.

While many individual government offices have achieved registration, the FAA's Aviation Safety employees have accomplished this across a complex and diverse line of business worldwide. They have raised the agency's standards and are now pacesetters in government.

Under the leadership of Associate Administrator for Aviation Safety Nicholas A. Sabatini, the organization promotes aviation safety and oversees compliance with Federal regulations as applied to airmen, manufacturers, repair and maintenance facilities, aviation schools, operators, aviation agencies, individuals and organizations. It is comprised of the Flight Standards Service, Aircraft Certification Service, Office of Aerospace Medicine, Office of Rulemaking, Office of Accident Investigation, Air Traffic Safety Oversight Service, Suspected Unapproved Parts Program, and the Office of Quality, Integration, and Executive Services. With a budget of $948 million, the organization employs over 6,400 people in the FAA's Washington Headquarters, nine regional offices, and more than 125 field offices throughout the world.

ISO is the world's largest developer of voluntary international standards with a current portfolio of more than 16,200. The ISO 9000 family of standards makes a positive difference, not just to engineers and manufacturers, but to regulators, consumers and end users, by targeting quality management. For more information on ISO, go to <www.iso.org>.

NEW YORK'S EAST RIVER FLIGHT RESTRICTION

After a review of operations and procedures in the Visual Flight Rules Corridor over the East River in New York City, the Federal Aviation Administration (FAA) announced on October 13 that it is excluding fixed-wing aircraft from the corridor for safety considerations, unless they obtain authorization from and are being controlled by air traffic control.

The announcement, which came in the form of a *Notice to Airmen* (NOTAM FDC 6/3495), noted that the restriction is effective immediately and will remain in place pending further review of current guidelines by the FAA and its government and industry partners.

Seaplanes operating in and out of the New York Skyports Seaplane Base will be permitted to continue operations in the corridor, which extends from the southwestern tip of Governor's Island to the North tip of Roosevelt Island, below an altitude of 1,100 feet. Helicopter operations in the East River corridor are not affected by this change.

NEW FAA FORUM TO REVIEW AGE 60 RULE FOR PILOTS

On September 27, Federal Aviation Administration (FAA) Administrator Marion C. Blakey established a forum of airline, labor, and medical experts to recommend whether the United States should adopt the new International Civil Aviation Organization (ICAO) standard that will allow one of the two pilots in the flight deck to be over age 60. The forum also will determine what actions would be necessary if the FAA were to change its rule.

"The FAA must ensure that any future rule change, should it occur, provides an equal or better level of safety to passengers," said Blakey. "I'm looking forward to hearing from the experts so the FAA can make informed decisions as the ICAO standard is implemented and Congress considers this issue."

Since 1959, Title 14 Code of Federal Regulations §61.3(j), Age limitation for certain operations, prohibits pilots, who are over the age of 60 and working for 14 CFR part 121 operators, from serving as a required pilot crewmember.

On November 23rd, ICAO, the United Nations' aviation organization, will increase the upper age limit for pilots to age 65, provided that one of the two pilots in the cockpit is under age 60.

The Age 60 Aviation Rulemaking Committee has been tasked to complete its work within 60 days. Committee members will represent airlines, pilot unions, medical experts, and the FAA.

Editor's Runway

Welcome Aboard

It has been more than 16 years since the *FAA Aviation News* has added a new writer to its staff. I was that writer. The year was 1990. Since then, the magazine has only added one other person to its staff. That person was Mario Toscano, the magazine's designer in 1993. Although we all have other duties, we, Mario, Louise Oertly, and I, think of the magazine as our primary duty. But frankly, at times our other duties limit the amount of time we can spend researching new material for the magazine. That is why we encourage you, our readers, to take an active role in promoting aviation safety by submitting material and ideas to the publication. To help better serve you, our readers, help has arrived.

It is my pleasure to announce the arrival of the newest member of the magazine's staff, James R. Williams. A graduate student completing his degree requirements at the Florida Institute of Technology for a December Masters Degree in Applied Aviation Safety, James brings to the staff a fresh perspective on aviation and aviation safety. As a private pilot with an instrument rating, he also brings to the staff an insight into what his generation of 20-something year olds are thinking and how they perceive aviation.

James reported for duty on October 15. Although he will be kept busy learning his new duties and completing certain training, we are looking forward to his contributions to the magazine. As we introduce him to aviation and the FAA, if you happen to see or meet him at an aviation meeting or event, please help us welcome the newest member of the staff by saying hello to James. Welcome aboard James.

Although it was exciting being involved in the hiring process of our newest staff member and waiting for him to start work, we also had a sad moment as our branch manager, Ms. Copper Perry, left. She accepted a position in the FAA's Human Resources Management organization. We will miss her, but we are thankful she was able to select James as one of her last acts as our branch manager.

As we wrap up this last issue of the year, we want to take a moment to thank you, our readers, for your support and help over the past year. We especially want to thank those who submitted story ideas and material for publication in the magazine. As a non-commercial government safety magazine, we don't have a budget to pay for articles. So when you see a great article from someone from the aviation community published in the magazine, please remember that person submitted that material as a public service. Thank you.

The staff of *FAA Aviation News*, Louise, Mario, James, and myself extends our best wishes to all of you for a safe and happy holiday season. And don't forget to keep the blue side up. Have a safe 2007 flying season.

U.S. Department
of Transportation

**Federal Aviation
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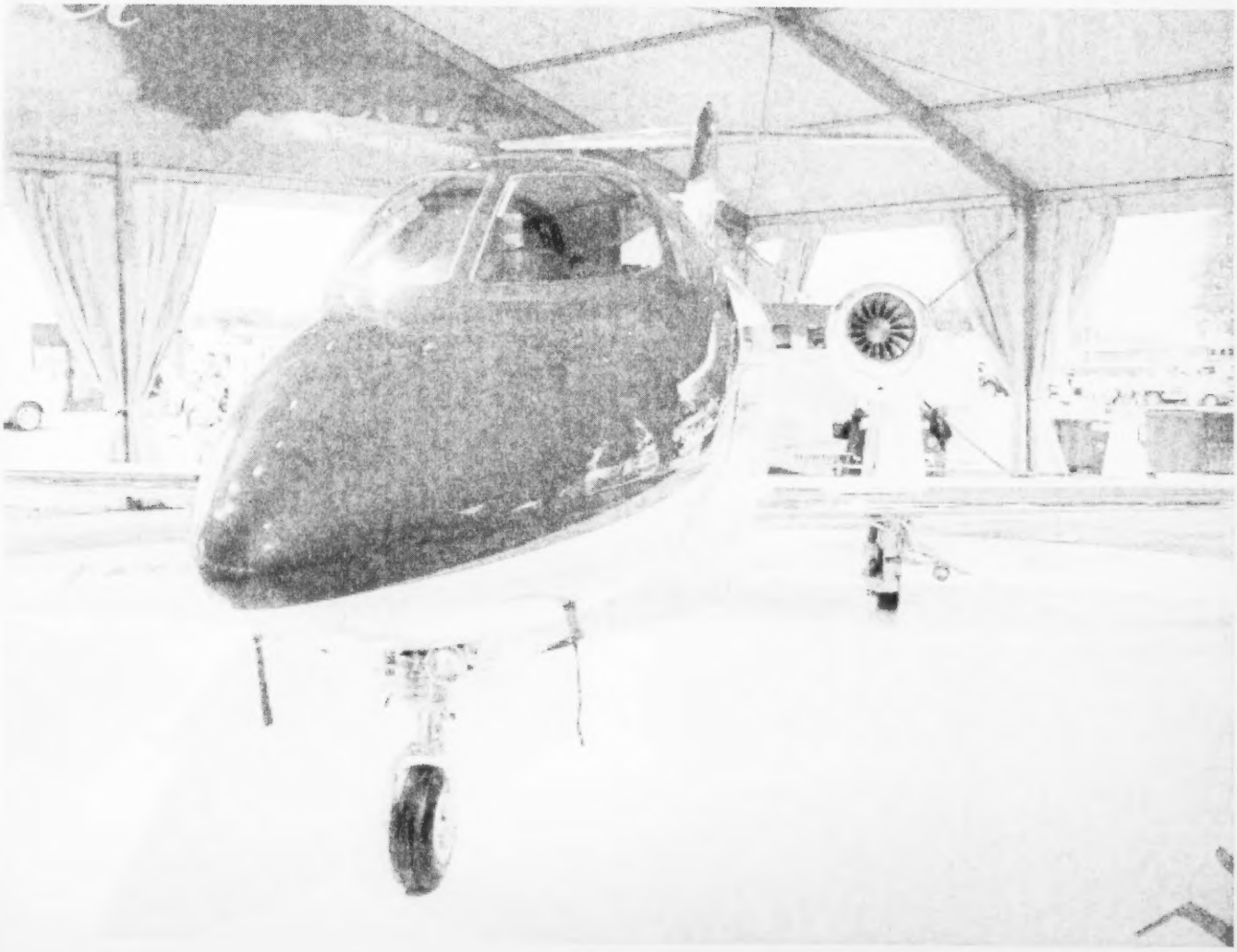

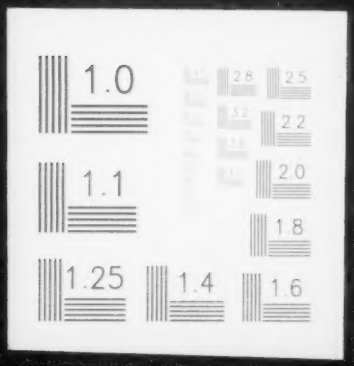
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